Browne's Graded School Arithmetic

BOOK ONE

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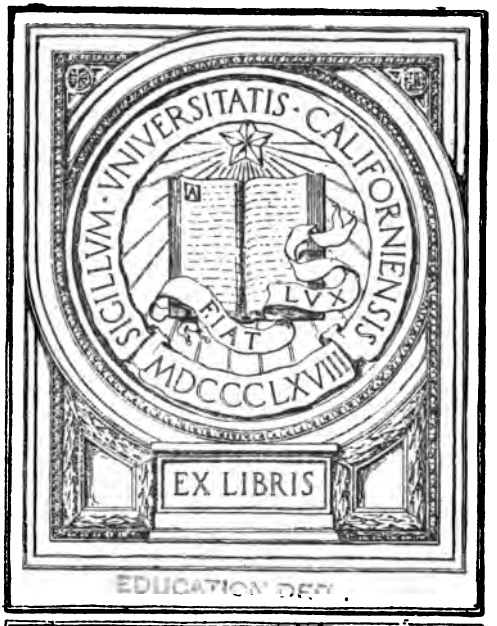

GRADED

SCHOOL ARITHMETIC

BOOK ONE

AN ELEMENTARY TEXT FOR USE IN PUBLIC AND PRIVATE SCHOOLS, FROM THE FIRST TO THE FIFTH YEAR, INCLUSIVE

BY

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SAN FRANCISCO
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PREFACE.

THIS text-book is presented with the belief that it supplies the demand for better methods of presenting the subject.

As to the general method employed, the author is permitted to quote from a bulletin on "The Teaching of Primary Numbers," by Professor Frank F. Bunker, of the San Francisco State Normal School: —

"The study of every topic generally included in a course in arithmetic can be begun either from the objective side or from the side of the purely formal. For instance, in beginning the study of fractions the teacher can give a more or less extended course wholly within the field of the concrete, or she may choose to begin with the formal and mechanical side, — the side which is concerned alone with the various manipulations of fraction symbols. Just so with square root, with division, with multiplication, or in fact with almost any phase of arithmetic. On the one hand, there is the field of the objective, — the concrete; on the other, the field of the formal. Careful observation of practice-work will show, as we have just said, that facility in one field will by no means give facility in the other. A child, by careful teaching in the field of the concrete, will soon acquire great skill in adding simple fractions, and yet he may never have seen those same fractions expressed by figure symbols. He does this by reason of the fact that to him a fraction is as much a concrete thing as is his dog or his horse. To him, adding fractions is nothing more than calling up and counting mental images of familiar things. On the other hand, the mind is never more devoid of mental images than when engaged in formal calculation. To have images of things floating around at such a time means that attention is diverted, with ineffectiveness as a consequence. Obviously, the child needs training in both these fields. He needs to be accurate and tolerably rapid in the mechanical work of

fractions, and at the same time he needs the power to see visually the relation between one fourth and one third of a foot."

From a standard work on arithmetic, published about forty years ago, is taken the following extract, which accords with the more recent authorities on number-teaching: —

"All reasoning is *comparison*. A comparison requires a standard, and this standard is the *fixed*, the *axiomatic*, the *known*. The law of correct reasoning, therefore, is to compare the *complex* to the *simple*, the *theoretic* to the *axiomatic*, the *unknown* to the *known*. The law is kept prominently before the mind in the development of this work, and upon it are based its solutions and explanations."

As to subject-matter, the book is graded to suit the mental capacity of the pupil as he moves upward, through the grades of the public schools. Not all subjects to be found in other arithmetics are treated, but the matter of *relation* is presented so effectively, that it is believed the pupil will be able to apply the principles to the many details which may arise in his experience.

The teacher should always remember to provide inductive exercises, to make clear any principle not fully mastered by the pupil. There is no better test of a pupil's insight than original problems, which should be required at every step of progress.

As to typography, much care has been exercised to make this book superior to others in artistic finish. Its attractive style adds to its value as a text.

With the hope that it will inspire deeper interest in the subject, and will be of service to all who may use it, the consideration of schools and teachers everywhere is invited.

FRANK J. BROWNE.

SAN FRANCISCO, CALIFORNIA,
March, 30, 1903.

COURSE OF STUDY.

Original Problems should be required throughout the Course.

GRADED SCHOOL ARITHMETIC.

1. Draw on the blackboard a line one foot long.
2. Show that one foot and one foot are two feet.
3. Show that one foot and two feet are three feet.
4. Show that two feet and one foot are three feet.
5. Show that one foot and three feet are four feet.
6. Show that three feet and one foot are four feet.
7. Show that four feet less one foot are three feet.
8. Show that four feet less two feet are two feet.
9. Show that four feet less three feet is one foot.
10. Show that three feet less one foot are two feet.
11. Show that one half of two feet is one foot.
12. Show that one half of four feet is two feet.
13. Show that two and one and one are four.
14. Count to ten, and from ten back to one.
15. Read and write numbers to ten.

Write and read—

16. 1 foot+1 foot=2 feet.
17. 1 foot+2 feet=3 feet.
18. 1 foot+3 feet=4 feet.
19. 2 feet+2 feet=4 feet.
20. 2 feet—1 foot=1 foot.
21. 3 feet—1 foot=2 feet.
22. 3 feet—2 feet=1 foot.
23. 4 feet—1 foot=3 feet.
24. 4 feet—2 feet=2 feet.
25. 4 feet—3 feet=1 foot.

26. $1+$1=$2
27. 2+ 1= 3
28. 3+ 1= 4
29. 2+ 2= 4
30. 2— 1= 1
31. 3— 1= 2
32. 3— 2= 1
33. 4— 1= 3
34. 4— 2= 2
35. 4— 3= 1

1. Memorize

pt.=pint. ft.=foot (or feet).
qt.=quart. ½=one half.

2. Count and write numbers to 20.
3. Count by 2's: 2, 4, 6, 8, 10, 12.

4. One qt.= 2 pt.
5. Two qt.=__pt.
6. Three qt.=__pt.
7. Four qt.=__pt.
8. Five qt.=__pt.
9. Six qt.=__pt.

10. Two pt.= 1 qt.
11. Four pt.=__qt.
12. Six pt.=__qt.
13. Eight pt.=__qt.
14. Ten pt.=__qt.
15. Twelve pt.=__qt.

16. ½ of 2 qt.= 1 qt.
17. ½ of 4 qt.=__qt.
18. ½ of 6 qt.=__qt.
19. ½ of 8 qt.=__qt.
20. ½ of 10 qt.=__qt.
21. ½ of 12 qt.=__qt.

22. One is ½ of what?
23. Two is ½ of what?
24. Three is ½ of what?
25. Four is ½ of what?
26. Five is ½ of what?
27. Six is ½ of what?

28. 2 times $2=$____.
29. 2 times 3= ____.
30. 2 times 4= ____.
31. 2 times 5= ____.
32. 2 times 6= ____.

33. $2 divided by 2=$____.
34. 4 divided by 2= ____.
35. 6 divided by 2= ____.
36. 8 divided by 2= ____.
37. 10 divided by 2= ____.

38.	39.	40.	41.
2+1=____	4−2=____	2×2=____	4÷2=____
2+2=____	5−2=____	2×3=____	6÷2=____
2+4=____	6−2=____	2×4=____	8÷2=____
2+6=____	8−2=____	2×5=____	10÷2=____

1. Draw a line three feet long.
2. One foot is what part of three feet?
3. One foot is what part of a yard?
4. Two feet are what part of a yard?
5. Three feet are three times what?
6. Three feet are what part of a yard?
7. How many feet are in two yards?
8. How many feet are in one and one third yards?
9. How many three-foot lines are in a six-foot line?
10. How many two-foot lines are in a six-foot line?
11. How many feet are in one half of six feet?
12. How many feet are in one third of six feet?
13. How many feet are in one half of two yards?
14. How many feet are in one third of two yards?
15. How much will two apples cost if one costs two cents?
16. How much will two apples cost if one costs three cents?
17. How much will three apples cost if one costs two cents?
18. How much will one apple cost if two cost four cents?
19. How much will one apple cost if two cost six cents?
20. How much will one apple cost if three cost six cents?
21. Use a pint measure and fill a quart measure.
22. How many pints are in two quarts?
23. How many quarts are in two pints?
24. How many quarts are in one pint?
25. How many quarts are in three pints?
26. How many quarts are in four pints?
27. How many quarts are in five pints?
28. How many pints are in one half of one quart?
29. How many pints are in one half of four quarts?
30. How many pints are in one half of three quarts?
31. How many pints are in one and one half quarts?
32. How many pints are in two and one half quarts?

1. Memorize—

2 pints make 1 quart.
4 quarts make 1 gallon.

2. Count and write numbers to 50.
3. Count by 2's from 2 to 20.
4. Count by 3's from 3 to 15.
5. Count by 4's from 4 to 12.
6. One gallon makes how many quarts?
7. One half of a gallon makes how many quarts?
8. One quart is what part of a gallon?
9. Two quarts are what part of a gallon?
10. How many half-gallons are in a whole gallon?
11. How many fourths of a gallon are in a whole gallon?
12. How many pints are in a gallon?
13. How many pints are in a half-gallon?
14. How many pints are in one fourth of a gallon?
15. How many quarts are in two gallons?
16. How many quarts are in one and one half gallons?
17. How many quarts are in one and one fourth gallons?
18. How many quarts are in two and one half gallons?
19. How many quarts are in two and one fourth gallons?
20. Find the cost of two apples at 5 cents each.
21. Find the cost of three pencils at 4 cents each.
22. Find the cost of a quart of milk at three cents a pint.

23.	24.	25.
1 equals__halves.	1 qt. equals__pt.	1 pt. equals__qt.
1½ equals__halves.	2 qt. equal __pt.	2 pt. equal __qt.
2 equals__halves.	1½ qt. equal __pt.	3 pt. equal __qt.
2½ equals__halves.	2½ qt. equal __pt.	4 pt. equal __qt.
3 equals__halves.	3 qt. equal __pt.	5 pt. equal __qt.

1. Count by 2's from 2 to 20, and back from 20 to 2.
2. Count by 2's from 1 to 21, and back from 21 to 1.
3. Count by 3's from 3 to 21, and back from 21 to 3.
4. Count by 4's from 4 to 20, and back from 20 to 4.
5. Count by 5's from 5 to 20, and back from 20 to 5.
6. How many cents are in a nickel?
7. How many cents are in two nickels?
8. How many cents are in three nickels?
9. One cent is what part of a nickel?
10. Two cents are what part of a nickel?
11. Three cents are what part of a nickel?
12. How many cents are in a dime?
13. How many cents are in one half of a dime?
14. How many cents are in one fifth of a dime?
15. How many cents are in two fifths of a dime?
16. How many cents are in a dime and a nickel?
17. How many 2-cent stamps can you buy with a dime?
18. How many 2-cent stamps can you buy with a nickel?
19. How many 3-cent stamps can you buy with a nickel?
20. How many 3-cent stamps can you buy with a dime?
21. Are two dimes worth more than three nickels?
22. Are two dimes worth more than four nickels?
23. A 1-cent stamp is worth what part of a nickel?
24. A 2-cent stamp is worth what part of a dime?
25. One half of $4 + \frac{1}{2}$ of $6 + \frac{1}{2}$ of 2 equals what?
26. One third of $3 + \frac{1}{2}$ of $4 + \frac{1}{3}$ of 6 equals what?
27. One half of $6 + \frac{1}{2}$ of $8 + \frac{1}{4}$ of 8 equals what?
28. One half of $8 + \frac{1}{3}$ of $6 + \frac{1}{3}$ of 9 equals what?
29. One half of $10 + \frac{1}{2}$ of $8 + \frac{1}{5}$ of 10 equals what?
30. One fifth of $10 + \frac{1}{3}$ of $6 + \frac{1}{4}$ of 8 equals what?
31. One half of $4 + \frac{1}{2}$ of $6 + \frac{1}{2}$ of 8 equals what?
32. One third of $3 + \frac{1}{2}$ of $4 + \frac{1}{3}$ of 12 equals what?

1. What is the meaning of a surface?
2. What is the meaning of a square foot?
3. Draw a figure with a surface of one square foot.
4. Draw a figure with a surface of two square feet.
5. What part of two square feet is one square foot?
6. Draw a square each side of which is two feet long.
7. How many square feet are in this square?
8. What part of the figure is one square foot?
9. What part of the figure are two square feet?
10. Draw a row of three square feet on a three-foot line.
11. Draw another row of three square feet upon the first.
12. Draw a third row of three square feet upon the second.
13. How many square feet in the whole figure?
14. How many feet around the whole figure?
15. Draw a square yard, and divide it into square feet.
16. How many square feet in a square yard?
17. What part of a square yard is one square foot?
18. What part of a square yard are two square feet?
19. What part of a square yard are three square feet?
20. What part of a square yard are four square feet?
21. What part of a square yard are five square feet?
22. What part of a square yard are six square feet?
23. How many sq. ft. are in one third of a sq. yd.?
24. How many sq. ft. are in two thirds of a sq. yd.?
25. How many rows of three sq. ft. are in a sq. yd.?
26. How many rows of three sq. ft. are in two sq. yd.?
27. One row of three sq. ft. is what part of a sq. yd.?
28. One row of three sq. ft. is what part of two sq. yd.?
29. Four rows of three sq. ft. are how many sq. yd.?
30. Six rows of three sq. ft. are how many sq. yd.?
31. Seven rows of three sq. ft. are how many sq. yd.?
32. Nine rows of three sq. ft. are how many sq. yd.?

1. Count and write numbers to 100.
2. Count by 2's from 20 to 50, and back from 50 to 20.
3. Count by 2's from 21 to 51, and back from 51 to 21.
4. Count by 3's from 3 to 48, and back from 48 to 3.
5. Count by 3's from 1 to 49, and back from 49 to 1.
6. Count by 3's from 2 to 50, and from 50 back to 2.
7. Count by 4's from 4 to 48, and back from 48 to 4.
8. Count by 4's from 3 to 51, and back from 51 to 3.
9. Count by 4's from 2 to 50, and back from 50 to 2.
10. Count by 4's from 1 to 49, and back from 49 to 1.
11. How many cents are in one dime?
12. How many cents are in three dimes?
13. How many cents are in four dimes?
14. How many cents are in five dimes?
15. How many cents are in one half of a dime?
16. How many nickels are worth $1\frac{1}{2}$ dimes?
17. How many nickels are worth $2\frac{1}{2}$ dimes?
18. How many nickels are worth 3 dimes?
19. How many nickels are worth $3\frac{1}{2}$ dimes?
20. How many nickels are worth 4 dimes?
21. How many nickels are worth $4\frac{1}{2}$ dimes?
22. How many nickels are worth 5 dimes?
23. One and one half dimes are how many cents?
24. Two and one half dimes are how many cents?
25. Three and one half dimes are how many cents?
26. What part of fifty cents is one dime?
27. What part of forty cents is one dime?
28. What part of thirty cents is one dime?
29. What part of twenty cents is one dime?
30. What part of twenty cents is a nickel?
31. What part of twenty-five cents is a nickel?
32. What part of thirty cents is a nickel?

1. Memorize—

	2	2	2	2	2	2	2	2	2	2	2
	2	2	2	2	2	2	2	2	2	2	2
2×2= 4..	4	2	2	2	2	2	2	2	2	2	2
3×2= 6.....		6	2	2	2	2	2	2	2	2	2
4×2= 8.....			8	2	2	2	2	2	2	2	2
5×2=10.....				10	2	2	2	2	2	2	2
6×2=12.....					12	2	2	2	2	2	2
7×2=14.....						14	2	2	2	2	2
8×2=16.....							16	2	2	2	2
9×2=18.....								18	2	2	2
10×2=20.....									20	2	2
11×2=22.....										22	2
12×2=24.....											24

2. Count by 5's from 1 to 51, and back from 51 to 1.
3. Count by 5's from 2 to 52, and back from 52 to 2.
4. Count by 5's from 3 to 53, and back from 53 to 3.
5. Count by 5's from 4 to 54, and back from 54 to 4.
6. Count by 6's from 6 to 48, and back from 48 to 6.
7. What is the cost of 3 apples at 2¢ each?
8. What is the cost of 3 hats at $3 each?
9. What is the cost of 6 barrels of flour at $2 a barrel?
10. What is the cost of 2 tons of coal at $9 a ton?
11. What is the cost of 2 yards of cloth at $7 a yard?
12. What is the cost of ½ yard of ribbon at 10¢ a yard?
13. What is the cost of ½ dozen eggs at 20¢ a dozen?
14. What is the cost of ½ pound of candy at 12¢ a pound?
15. What is the cost of 2 books at 12 cents each?
16. What is the cost of 12 apples at 2 cents each?
17. What is the cost of 11 hats at $2 each?
18. What is the cost of 8 pounds of fruit at 2¢ a pound?

1. If 1 apple costs 2 cents, what will 3 apples cost?
2. If 1 apple costs 2 cents, how many will 8 cents buy?
3. If 5 apples cost 10 cents, what is the cost of 1 apple?
4. What will 9 hats cost at $2 each?
5. How many books will $20 buy at $2 each?
6. What will seven 2-cent postage-stamps cost?
7. How many 2-cent stamps will 18 cents buy?
8. At $2 a day, what will a boy earn in a week?
9. At $2 a barrel, what will 8 barrels of apples cost?
10. Willie had 11 cents, and lost 2. How many were left?
11. At $2 a day, what will a man earn in 10 days?
12. What will 5 pencils cost at 3 cents each?
13. Find the cost of 1 book if 3 cost 24 cents.
14. If 3 pencils cost 15 cents, what does 1 cost?
15. At $3 an acre, what will 12 acres cost?
16. Henry has 2 marbles and Willie has twice as many. How many has Willie? How many have both?
17. There are 2 cows in one field, and twice as many in another. How many in the second field? How many in both?
18. Albert has 3 cents in one pocket, and twice as many in another. How many cents in the other pocket? How many in both?
19. Mary has two 2-cent stamps in one box, and two in another. What are all her stamps worth?
20. Henry walks 2 miles to school once a day. How many miles does he walk to and from school in five days?
21. Tom has 3 marbles, Willie has 2, and Albert has as many as Tom and Willie together. How many have they all?
22. Lowell paid 5 cents for pens, and twice as much for paper. What did both cost?
23. Lucy had 5 cents, and Tom had twice as many. How many had both?

1. Memorize —

12 inches make 1 foot.
3 feet make 1 yard.

2. How many inches are marked on your foot rule?
3. One half of a foot is how many inches?
4. One third of a foot is how many inches?
5. One fourth of a foot is how many inches?
6. One sixth of a foot is how many inches?
7. Two thirds of a foot are how many inches?
8. Two fourths of a foot are how many inches?
9. Two sixths of a foot are how many inches?
10. Three thirds of a foot are how many inches?
11. Three fourths of a foot are how many inches?
12. Three sixths of a foot are how many inches?
13. One inch is what part of a foot?
14. Two inches are what part of a foot?
15. Three inches are what part of a foot?
16. Four inches are what part of a foot?
17. Six inches are what part of a foot?
18. Draw a square inch. How many inches around it?
19. Draw a 2-inch square. How many square inches in it?
20. Draw a 3-inch square. How many square inches in it?
21. Draw a figure 2 inches wide and 6 inches long.
22. How many square inches in the figure?
23. How many rows of six square inches in the figure?
24. How many rows of two square inches in the figure?
25. Draw a figure 3 inches wide and 4 inches long.
26. How many square inches in the figure?
27. How many rows of three square inches in the figure?
28. How many rows of four square inches in the figure?
29. Show how to divide the figure into thirds.

1. Count and write numbers to 200.
2. Count by 6's from 6 to 48, and back from 48 to 6.
3. Count by 7's from 7 to 49, and back from 49 to 7.

4. How many qt. in 2 pt.?
5. How many qt. in 4 pt.?
6. How many qt. in 1 pt.?
7. How many qt. in 5 pt.?
8. How many qt. in 6 pt.?
9. How many qt. in 7 pt.?
10. How many qt. in 9 pt.?
11. How many qt. in 11 pt.?
12. How many qt. in 16 pt.?
13. How many qt. in 17 pt.?
14. How many qt. in 14 pt.?
15. How many qt. in 20 pt.?
16. How many qt. in 19 pt.?

17. One half of 4 pt.=___.
18. One half of 5 pt.=___.
19. One half of 7 qt.=___.
20. One half of $9=___.
21. One half of 24 ft. =___.
22. One half of 25 ft. =___.
23. One half of 11 yd.=___.
24. One half of 13 yd.=___.
25. One half of 20¢=___.
26. One half of 21¢=___.
27. One half of 22¢=___.
28. One half of 23¢=___.
29. One half of 19¢=___.

30. Two and 5 and 6 less 4 are how many?
31. Two and 6 and 7 less 5 are how many?
32. Two and 7 and 8 less 6 are how many?
33. Two and 8 and 6 less 5 are how many?
34. Three and 8 and 5 less 6 are how many?
35. Three and 7 and 6 less 5 are how many?
36. Four and 4 and 6 less 7 are how many?
37. Four and 6 and 8 less 5 are how many?
38. Five and 7 and 5 less 6 are how many?
39. Five and 4 and 6 less 7 are how many?
40. Six and 8 and 3 less 4 are how many?
41. Six and 7 and 4 less 5 are how many?
42. Seven and 6 and 5 less 4 are how many?
43. Seven and 7 and 5 less 6 are how many?

1. 1 yard equals __ft.
2. 1 yd. and 1 ft. equal__ft.
3. 2 yd. and 1 ft. equal__ft.
4. 4 yd. and 2 ft. equal__ft.
5. 5 yd. and 1 ft. equal__ft.
6. $2\frac{1}{3}$ yd. equal__ft.
7. $2\frac{2}{3}$ yd. equal__ft.
8. $3\frac{1}{3}$ yd. equal__ft.
9. $4\frac{1}{3}$ yd. equal__ft.
10. $5\frac{1}{3}$ yd. equal__ft.

11. 3 ft. equal 1 yd.
12. 6 ft. equal __yd.
13. 9 ft. equal __yd.
14. 1 ft. equals__yd.
15. 4 ft. equal __yd.
16. 7 ft. equal __yd.
17. 10 ft. equal __yd.
18. 11 ft. equal __yd.
19. 13 ft. equal __yd.
20. 15 ft. equal __yd.

21. 1 equals 3 thirds.
22. $1\frac{1}{3}$ equals__thirds.
23. $1\frac{2}{3}$ equals__thirds.
24. 2 equals__thirds.
25. $2\frac{1}{3}$ equals__thirds.
26. $2\frac{2}{3}$ equals__thirds.
27. 3 equals__thirds.
28. $3\frac{1}{3}$ equals__thirds.
29. 4 equals__thirds.
30. $4\frac{1}{3}$ equals__thirds.

31. $\frac{1}{3}$ of 1 equals__.
32. $\frac{1}{3}$ of 2 equals__.
33. $\frac{1}{3}$ of 3 equals__.
34. $\frac{1}{3}$ of 4 equals__.
35. $\frac{1}{3}$ of 5 equals__.
36. $\frac{1}{3}$ of 6 equals__.
37. $\frac{1}{3}$ of 7 equals__.
38. $\frac{1}{3}$ of 8 equals__.
39. $\frac{1}{3}$ of 9 equals__.
40. $\frac{1}{3}$ of 12 equals__.

41. 10 cents= 1 dime.
42. 20 cents=__dimes.
43. 5 cents=__dime.
44. 2 cents=__dime.
45. 11¢=__dime and__¢.
46. 12¢=__dime and__¢.
47. 14¢=__dime and__¢.
48. 19¢=__dime and__¢.
49. 25¢=__dimes and__¢.
50. 22¢=__dimes and__¢.

51. $\frac{1}{2}$ dime =__¢.
52. $\frac{1}{5}$ dime =__¢.
53. $\frac{2}{5}$ dime =__¢.
54. $\frac{3}{5}$ dime =__¢.
55. 2 dimes=__¢.
56. $2\frac{1}{2}$ dimes=__¢.
57. 2^1 dimes=__¢.
58. $1\frac{2}{5}$ dimes=__¢.
59. $1\frac{3}{5}$ dimes=__¢.
60. $1\frac{4}{5}$ dimes=__¢.

1. Draw a 3-inch square. How many square inches in it?
2. Make the figure 4 inches in length.
3. How many inches in the perimeter of the figure?
4. How many square inches in the area of the figure?
5. How many rows of 3 square inches in the figure?
6. How many rows of 4 square inches in the figure?
7. One row of 3 square inches is what part of the figure?
8. One row of 4 square inches is what part of the figure?
9. Make the figure 5 inches in length.
10. How many rows of 3 square inches in the figure?
11. How many rows of 5 square inches in the figure?
12. How many inches in the perimeter of the figure?
13. How many square inches in the area of the figure?
14. One row of 3 square inches is what part of the figure?
15. One row of 5 square inches is what part of the figure?
16. Make the figure 6 inches in length.
17. How many inches in the perimeter of the figure?
18. How many square inches in the area of the figure?
19. How many rows of 3 square inches in the figure?
20. How many rows of 6 square inches in the figure?
21. One row of 3 square inches is what part of the figure?
22. One row of 6 square inches is what part of the figure?
23. Make the figure 7 inches in length.
24. How many inches in the perimeter of the figure?
25. How many rows of 3 square inches in the figure?
26. How many rows of 7 square inches in the figure?
27. How many square inches in the area of the figure?
28. One row of 3 square inches is what part of the figure?
29. One row of 7 square inches is what part of the figure?
30. Are 3 times 5 more than 5 times 3? Show by drawing.
31. Are 6 times 3 less than 3 times 6? Show by drawing.
32. Are 7 times 3 less than 3 times 7? Show by drawing.

1. Memorize—

	3	3	3	3	3	3	3	3	3	3	3
	3	3	3	3	3	3	3	3	3	3	3
2×3= 6..	6	3	3	3	3	3	3	3	3	3	3
3×3= 9.....		3	3	3	3	3	3	3	3	3	3
4×3=12.....			3	3	3	3	3	3	3	3	3
5×3=15.....				3	3	3	3	3	3	3	3
6×3=18.....					3	3	3	3	3	3	3
7×3=21.....						3	3	3	3	3	3
8×3=24.....							3	3	3	3	3
9×3=27.....								3	3	3	3
10×3=30.....									3	3	3
11×3=33.....										3	3
12×3=36.....											

2. Count by 6's from 6 to 48, and back from 48 to 6.
3. Count by 6's from 5 to 47, and back from 47 to 5.
4. Count by 6's from 4 to 46, and back from 46 to 4.
5. Count by 6's from 3 to 45, and back from 45 to 3.
6. Count by 6's from 2 to 44, and back from 44 to 2.
7. Count by 6's from 1 to 43, and back from 43 to 1.
8. Count by 7's from 7 to 49, and back from 49 to 7.
9. What is the cost of 3 pencils at 5 cents each?
10. What is the cost of 3 tops at 10 cents each?
11. What is the cost of 3 tons of coal at $8 a ton?
12. What is the cost of 3 cords of wood at $7 a cord?
13. What is the cost of 9 quarts of milk at 3¢ a quart?
14. What is the cost of 12 chairs at $3 each?
15. What is the cost of ½ dozen eggs at 20¢ a dozen?
16. What is the cost of ¼ dozen hats at $24 a dozen?
17. What is the cost of ⅓ dozen chairs at $30 a dozen?
18. What is the cost of ⅓ dozen hats at $21 a dozen?

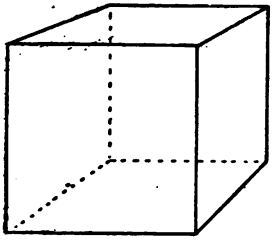
1. At 10 cents each, what will 3 melons cost?
2. At $3 each, how many hats will $24 buy?
3. At 6 cents a pound, what will 4 pounds of sugar cost?
4. At 5 cents a yard, how many yards will 20 cents buy?
5. At $4 a pair, what will 7 pairs of shoes cost?
6. At 8 cents a dozen, what will 4 dozen pens cost?
7. At $4 a barrel, what will 8 barrels of flour cost?
8. At $4 each, how many sheep will $32 buy?
9. At 4 cents each, how many oranges will 28 cents buy?
10. If 3 chairs cost $24, what is the cost of 1 chair?
11. If 4 melons cost 40 cents, what is the cost of 1?
12. If 4 books cost 36 cents, what is the cost of 1?
13. If 2 men do a piece of work in 4 days, in what time can 1 man do it?
14. If 1 man can do a piece of work in 20 days, in what time can 2 men do it?
15. If 1 man can do a piece of work in 20 days, in what time can 4 men do it?
16. If 1 man can build a fence in 6 days, in what time can 2 men build it?
17. If 1 man can build a fence in 6 days, in what time can 3 men build it?
18. If there are 4 pecks in 1 bushel, how many pecks are in 44 bushels?
19. If 1 man can dig a trench in 24 days, how many men can dig it in 8 days?
20. If 1 man can dig a trench in 24 days, how many men can dig it in 6 days?
21. At $4 a day, how long is required to earn $48?
22. At $4 a day, what will a man earn in $3\frac{1}{2}$ days?
23. At $6 a day, what will a man earn in $3\frac{1}{2}$ days?
24. At $6 a day, what will a man earn in $3\frac{2}{3}$ days?

1. Count by 5's from 5 to 100, and back from 100 to 5.
2. Count by 10's from 10 to 100, and back from 100 to 10.
3. Count by 10's from 11 to 101, and back from 101 to 11.
4. Count by 10's from 12 to 102, and back from 102 to 12.
5. Count by 10's from 13 to 103, and back from 103 to 13.
6. Two times 1 foot 1 inch equal ___ feet ___ inches.
7. Two times 1 foot 6 inches equal ___ feet ___ inches.
8. Three times 1 foot 1 inch equal ___ feet ___ inches.
9. Three times 1 foot 4 inches equal ___ feet ___ inches.
10. Four times 2 feet 1 inch equal ___ feet ___ inches.
11. Four times 2 feet 3 inches equal ___ feet ___ inches.
12. Six times 2 feet 1 inch equal ___ feet ___ inches.
13. Six times 2 feet 2 inches equal ___ feet ___ inches.

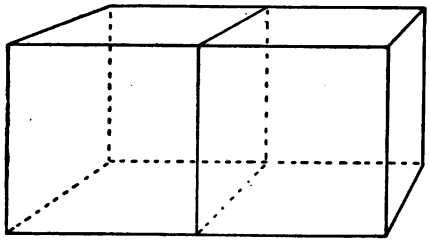
14.	15.	16.
$1 = \frac{3}{3}$	$\frac{1}{3}$ of $1 =$ ___	$3 \times \frac{1}{3} =$ ___
$1\frac{1}{3} =$ ___	$\frac{1}{3}$ of $2 =$ ___	$3 \times \frac{2}{3} =$ ___
$1\frac{2}{3} =$ ___	$\frac{1}{3}$ of $4 =$ ___	$3 \times 1\frac{1}{3} =$ ___
$2 =$ ___	$\frac{1}{3}$ of $5 =$ ___	$3 \times 2\frac{2}{3} =$ ___
$2\frac{1}{3} =$ ___	$\frac{1}{3}$ of $7 =$ ___	$3 \times 3\frac{1}{3} =$ ___
$2\frac{2}{3} =$ ___	$\frac{1}{3}$ of $8 =$ ___	$3 \times 3\frac{2}{3} =$ ___
$3 =$ ___	$\frac{1}{3}$ of $9 =$ ___	$3 \times 4\frac{1}{3} =$ ___
$3\frac{1}{3} =$ ___	$\frac{1}{3}$ of $10 =$ ___	$3 \times 4\frac{2}{3} =$ ___
$3\frac{2}{3} =$ ___	$\frac{1}{3}$ of $11 =$ ___	$3 \times 5\frac{1}{3} =$ ___

Mental work from dictation —

17. $2, +4, -3, +2 =$ ___
18. $5, -3, \times 4, +5 =$ ___
19. $6, \times 2, \div 3, +7 =$ ___
20. $7, \times 3, +3, \div 4 =$ ___
21. $8, \times 2, +4, \div 5 =$ ___
22. $9, \times 3, +3, \div 3 =$ ___
23. $9, +7, +4, \div 4 =$ ___
24. $8, \times 3, +4, \div 7 =$ ___
25. $6, +8, \div 2, \times 5 =$ ___
26. $3, \times 7, +6, \div 3 =$ ___
27. $5, \times 6, +6, \div 4 =$ ___
28. $6, \times 4, -6, \div 3 =$ ___



A 1-inch Cube.



Two 1-inch Cubes.

1. Draw a line 1 inch long.
2. Draw a surface 1 inch square.
3. How many edges has a cube?
4. How many faces has a cube?
5. Are all the edges of the same length?
6. Are all the faces of the same area?
7. Build a 2-inch cube with 1-inch cubes.
8. How many layers of cubes in the 2-inch cube?
9. How many rows of 1-inch cubes in each layer?
10. How many 1-inch cubes in each layer?
11. How many 1-inch cubes in the 2-inch cube?
12. What part of the 2-inch cube is a 1-inch cube?
13. What part of the 2-inch cube are 2 1-inch cubes?
14. What part of the 2-inch cube are 4 1-inch cubes?
15. What part of the 2-inch cube are 6 1-inch cubes?
16. Give the size of a box that holds 4 1-inch cubes.
17. Give the size of a box that holds 6 1-inch cubes.
18. Give the size of a box that holds 8 1-inch cubes.
19. Give the size of a box that holds 10 1-inch cubes.
20. Give the size of a box that holds 12 1-inch cubes.
21. Give the size of a box that holds 15 1-inch cubes.
22. Give the size of a box that holds 16 1-inch cubes.
23. Give the size of a box that holds 18 1-inch cubes.

1. Count by 7's from 7 to 49, and back from 49 to 7.
2. Count by 7's from 6 to 48, and back from 48 to 6.
3. Count by 7's from 5 to 47, and back from 47 to 5.
4. Count by 7's from 4 to 46, and back from 46 to 4.
5. Count by 7's from 3 to 45, and back from 45 to 3.
6. Count by 7's from 2 to 44, and back from 44 to 2.
7. Count by 7's from 1 to 43, and back from 43 to 1.
8. Count by 8's from 8 to 48, and back from 48 to 8.
9. Name the days of the week.
10. One day is what part of a week?
11. Two days are what part of a week?
12. Three days are what part of a week?
13. Four days are what part of a week?
14. Five days are what part of a week?
15. Six days are what part of a week?
16. What part of a week are the school days?
17. What part of the week are the working days?
18. What part of the week is Sunday?
19. How many months in a year?
20. Name the months, beginning with January.
21. How many months in spring? Name them.
22. How many months in summer? Name them.
23. How many months in autumn? Name them.
24. How many months in winter? Name them.
25. What part of a year is a month?
26. What part of a year is each season?
27. During what months is vacation?
28. What part of the year is vacation?
29. What part of a year are four months?
30. What part of a year are three months?
31. What part of a year are six months?
32. What part of a year are nine months?

1-oz. Weights.

4-oz. Weight.

8 oz. Weight.

NOTE.—Pupils should use the actual weights in this exercise.

1. Memorize—

16 ounces make 1 pound.
100 pounds make 1 cental.

2. Lift the pound weight. Is your book as heavy?
3. Lift the ounce weight. Is your ruler as heavy?
4. How many oz. weights are as heavy as 1 lb. weight?
5. How many ounces in one half of a pound?
6. How many ounces in one fourth of a pound?
7. How many ounces in one eighth of a pound?
8. One ounce equals what part of a pound?
9. Two ounces equal what part of a pound?
10. Three ounces equal what part of a pound?
11. The 1-ounce weight is what part of a pound?
12. The 4-ounce weight is what part of a pound?
13. The 8-ounce weight is what part of a pound?
14. The 1-oz. weight is what part of the 4-oz. weight?
15. The 4-oz. weight is what part of the 8-oz. weight?
16. The 1-oz. weight is what part of the 8-oz. weight?
17. What weights together equal 5 ounces?
18. What weights together equal 6 ounces?
19. What weights together equal 7 ounces?
20. What weights together equal 9 ounces?
21. What weights together equal 10 ounces?
22. What weights together equal 11 ounces?
23. What weights together equal 13 ounces?

1. Memorize —

10 cents make 1 dime.
10 dimes make 1 dollar.
100 cents make 1 dollar.

2. What part of a dime is 1 cent?
3. What part of a dime are 5 cents?
4. How many cents in two and one half dimes?
5. How many cents in four and one half dimes?
6. How many cents in five dimes?
7. How many cents in one half of a dollar?
8. How many cents in one fourth of a dollar?
9. How many 5-cent car fares will one quarter-dollar pay?
10. How many 5-cent car fares will one half-dollar pay?
11. What 2 pieces of money make one dime?
12. What 3 pieces of money make one fourth of a dollar?
13. What 5 pieces of money make one fourth of a dollar?
14. What 10 pieces of money make one half of a dollar?
15. What 5 pieces of money make one half of a dollar?
16. What 2 pieces of money make one half of a dollar?
17. What 2 pieces of money make one dollar?
18. What 4 pieces of money make one dollar?
19. What 10 pieces of money make one dollar?
20. What 3 pieces of money make twenty cents?
21. What 4 pieces of money make forty cents?
22. What 4 pieces of money make fifty cents?

Write from dictation, using the $ and the period (.)—

23.	24.	25.	26.
$5.00	$10.00	$100	$100.10
.50	.10	110	500.25
.05	.01	111	125.25

1. Memorize —

24 hours make 1 day.
30 days make 1 month.

2. Name the numbers on the clock face.
3. Explain the use of the two hands on the clock face.
4. How many hours of time are marked on the clock face?
5. How far does the short hand move in one hour?
6. How far does the long hand move in one hour?
7. How many hours in one half of a day?
8. How many hours in one third of a day?
9. How many hours in one fourth of a day?
10. How many hours in one sixth of a day?
11. How many hours in one eighth of a day?
12. How many hours in one twelfth of a day?
13. How many hours in two thirds of a day?
14. How many hours in three fourths of a day?
15. How many hours in two sixths of a day?
16. How many hours in three sixths of a day?
17. How many hours in two eighths of a day?
18. How many hours in three eighths of a day?
19. How many hours in four eighths of a day?
20. How many hours in five eighths of a day?
21. How many hours in two twelfths of a day?
22. How many hours in one and one half days?
23. How many hours in one and one third days?
24. How many hours in one and one fourth days?
25. How many hours in one and one eighth days?
26. What part of a day are two hours?
27. What part of a day are three hours?
28. What part of a day are four hours?
29. What part of a day are six hours?

1. Count by 3's from 3 to 30, and back from 30 to 3.
2. Count by 5's from 5 to 30, and back from 30 to 5.
3. Count by 6's from 6 to 30, and back from 30 to 6.
4. How many days in one half of a month?
5. How many days in one third of a month?
6. How many days in one fifth of a month?
7. How many days in one sixth of a month?
8. How many days in one tenth of a month?
9. What part of a month is one day?
10. What part of a month are two days?
11. What part of a month are three days?
12. What part of a month are five days?
13. What part of a month are six days?
14. What part of a month are ten days?
15. What part of a month are fifteen days?
16. How many days in two fifths of a month?
17. How many days in three fifths of a month?
18. How many days in three tenths of a month?
19. How many days in five tenths of a month?
20. How many days in five sixths of a month?
21. How many days in two thirds of a month?

If the first day of the month is Monday —

22. What day of the month will be the next Tuesday?
23. What day of the month will be the next Friday?
24. What day of the month will be the next Sunday?
25. What day of the month will be the next Monday?
26. On what day will be the 3d of the month?
27. On what day will be the 4th of the month?
28. On what day will be the 6th of the month?
29. What days of the month will be Mondays?
30. What days of the month will be Tuesdays?

1. Memorize —

8 quarts make 1 peck.
4 pecks make 1 bushel.

2. How many quarts in one bushel?
3. How many quarts in one half of a bushel?
4. How many quarts in one fourth of a bushel?
5. How many quarts in two pecks?
6. How many quarts in three pecks?
7. What part of a bushel are eight quarts?
8. What part of a bushel are four quarts?
9. What part of a bushel are two quarts?
10. What part of a bushel is one quart?
11. One and one half pecks are how many quarts?
12. One and one fourth pecks are how many quarts?
13. Two and one half pecks are how many quarts?
14. Two and one fourth pecks are how many quarts?
15. One half of a bushel contains how many quarts?
16. One fourth of a bushel contains how many quarts?
17. One eighth of a bushel contains how many quarts?
18. How many pecks in twelve quarts?
19. How many pecks in sixteen quarts?
20. How many pecks in twenty quarts?
21. How many pecks in twenty-four quarts?
22. How many pecks in twenty-eight quarts?
23. One quart is what part of a peck?
24. Two quarts are what part of a peck?
25. Four quarts are what part of a peck?
26. One quart is what part of two pecks?
27. One quart is what part of three pecks?
28. One peck is what part of two bushels?
29. One peck is what part of three bushels?

Find the area and perimeter of a rectangle —

1. Two inches wide and eight inches long.
2. Two inches wide and ten inches long.
3. Two inches wide and nine inches long.
4. Three inches wide and seven inches long.
5. Three inches wide and eight inches long.
6. Four inches wide and six inches long.
7. Four inches wide and seven inches long.
8. Four inches wide and eight inches long.
9. Five inches wide and four inches long.
10. Five inches wide and five inches long.
11. Five inches wide and six inches long.
12. Six inches wide and three inches long.
13. Six inches wide and four inches long.

Find the width and perimeter of a rectangle that is —

14. 4 inches long and contains 12 square inches.
15. 5 inches long and contains 20 square inches.
16. 5 inches long and contains 30 square inches.
17. 6 inches long and contains 18 square inches.
18. 6 inches long and contains 24 square inches.
19. 6 inches long and contains 30 square inches.
20. 8 inches long and contains 24 square inches.
21. 8 inches long and contains 32 square inches.
22. 9 inches long and contains 18 square inches.
23. 9 inches long and contains 27 square inches.
24. 9 inches long and contains 36 square inches.
25. 10 inches long and contains 30 square inches.
26. 10 inches long and contains 40 square inches.
27. 11 inches long and contains 22 square inches.
28. 11 inches long and contains 33 square inches.
29. 12 inches long and contains 24 square inches.

1. With inch cubes make a 3-inch square.
2. Place a second layer of cubes on the first layer.
3. Place a third layer of cubes on the second layer.
4. How many 1-inch cubes in the 3-inch cube?
5. What part of the 3-inch cube is a 1-inch cube?
6. What part of the 3-inch cube is 1 layer?
7. What part of the 3-inch cube is 1 row of 3 cubes?
8. How large is a solid that contains 6 1-inch cubes?
9. How large is a solid that contains 9 1-inch cubes?
10. How large is a solid that contains 10 1-inch cubes?
11. How large is a solid that contains 12 1-inch cubes?
12. How large is a solid that contains 8 1-inch cubes?
13. How large is a solid that contains 15 1-inch cubes?
14. How large is a solid that contains 16 1-inch cubes?
15. How large is a solid that contains 20 1-inch cubes?
16. How large is a solid that contains 18 1-inch cubes?
17. How large is a solid that contains 24 1-inch cubes?

Find the number of cubic inches in a solid —

18. Three in. long, 2 in. wide, and 2 in. high.
19. Four in. long, 2 in. wide, and 2 in. high.
20. Four in. long, 3 in. wide, and 2 in. high.
21. Four in. long, 3 in. wide, and 3 in. high.
22. Five in. long, 3 in. wide, and 3 in. high.
23. Five in. long, 3 in. wide, and 4 in. high.
24. Five in. long, 4 in. wide, and 4 in. high.
25. Six in. long, 3 in. wide, and 2 in. high.
26. Six in. long, 3 in. wide, and 3 in. high.
27. Six in. long, 4 in. wide, and 2 in. high.
28. Seven in. long, 2 in. wide, and 2 in. high.
29. Seven in. long, 2 in. wide, and 3 in. high.
30. Eight in. long, 2 in. wide, and 2 in. high.

1. Count by 3's from 3 to 36, and back from 36 to 3.
2. Count by 4's from 4 to 36, and back from 36 to 4.
3. Count by 6's from 6 to 36, and back from 36 to 6.
4. Count by 9's from 9 to 36, and back from 36 to 9.
5. Count by 12's from 12 to 36, and back from 36 to 12.
6. How many inches in one foot?
7. How many inches in one yard?
8. How many inches in one half of a yard?
9. How many inches in one third of a yard?
10. How many inches in one fourth of a yard?
11. How many inches in one sixth of a yard?
12. How many inches in one ninth of a yard?
13. How many inches in one twelfth of a yard?
14. What part of a foot are three inches?
15. What part of a yard are three inches?
16. What part of a foot are four inches?
17. What part of a yard are four inches?
18. What part of a foot are six inches?
19. What part of a yard are six inches?
20. One foot is what part of a yard?
21. Two feet are what part of a yard?
22. One and one half feet are what part of a yard?
23. One half of a foot is what part of a yard?
24. What part of two feet are three inches?
25. What part of two feet are four inches?
26. What part of two feet are six inches?
27. What part of two feet are eight inches?
28. What part of two feet are twelve inches?
29. Draw a square containing thirty-six square inches.
30. Draw an equal area three inches wide.
31. Draw an equal area four inches wide.
32. Draw an equal area one inch wide.

1. Draw the face of a clock.
2. What does the short hand of a clock show?
3. What does the long hand of a clock show?
4. How far does the short hand move in one hour?
5. How far does the long hand move in one hour?
6. How many minutes in one hour?
7. How many minutes in half an hour?
8. How many minutes in one quarter of an hour?
9. How many minutes in one third of an hour?
10. How many minutes in one fifth of an hour?
11. How many minutes in one sixth of an hour?
12. How many minutes in one tenth of an hour?
13. How many minutes in one twelfth of an hour?
14. Where is each hand of the clock at 12 o'clock?
15. Show on the clock face half-past 12.
16. Show on the clock face half-past 9.
17. Show on the clock face half-past 6.
18. Show on the clock face quarter-past 1.
19. Show on the clock face quarter-past 2.
20. Show on the clock face quarter-past 10.
21. Show on the clock face quarter before 11.
22. Show on the clock face 10 minutes before eleven.
23. Show on the clock face 5 minutes before eleven.
24. Show on the clock face 10 minutes past eleven.
25. Show on the clock face 5 minutes past eleven.
26. Show when school begins in the morning.
27. Show when school closes in the afternoon.
28. Show the time for recess in the morning.
29. How long from 9:00 A. M. to 1:00 P. M.?
30. How long from 9:00 A. M. to 1:30 P. M.?
31. How long from 9:30 A. M. to 2:00 P. M.?
32. How long from 9:00 A. M. to 3:30 P. M.?

1. Draw a rectangle 9 inches long and 6 inches wide.
2. How many square inches in the rectangle?
3. How many rows of 9 squares in it?
4. One row of 9 squares is what part of it?
5. Two rows of 9 squares are what part of it?
6. Three rows of 9 squares are what part of it?
7. How many rows of six squares in it?
8. One row of 6 squares is what part of it?
9. Two rows of 6 squares are what part of it?
10. Three rows of 6 squares are what part of it?
11. How many 3-inch squares in the rectangle?
12. One 3-inch square is what part of it?
13. Two 3-inch squares are what part of it?
14. Three 3-inch squares are what part of it?
15. Nine squares are what part of 18 squares?
16. Nine squares are what part of 27 squares?
17. Nine squares are what part of 36 squares?
18. Nine squares are what part of 45 squares?
19. Nine squares are what part of 54 squares?
20. Six squares are what part of 12 squares?
21. Six squares are what part of 18 squares?
22. Six squares are what part of 24 squares?
23. Six squares are what part of 30 squares?
24. Six squares are what part of 36 squares?
25. Six squares are what part of 42 squares?
26. Six squares are what part of 48 squares?
27. Six squares are what part of 54 squares?
28. How do you divide the rectangle into halves?
29. How do you divide the rectangle into thirds?
30. How do you divide the rectangle into sixths?
31. How many 3-inch squares in one half of it?
32. How many 3-inch squares in one third of it?

1. Count by 6's from 6 to 60, and back from 60 to 6.
2. Count by 7's from 7 to 70, and back from 70 to 7.
3. Count by 7's from 6 to 69, and back from 69 to 6.
4. Count by 7's from 5 to 68, and back from 68 to 5.
5. Count by 7's from 4 to 67, and back from 67 to 4.
6. Count by 7's from 3 to 66, and back from 66 to 3.
7. Count by 7's from 2 to 65, and back from 65 to 2.
8. Count by 7's from 1 to 64, and back from 64 to 1.
9. Count by 8's from 8 to 56, and back from 56 to 8.
10. Count by 8's from 7 to 55, and back from 55 to 7.
11. Draw a rectangle 8 inches long and 7 inches wide.
12. How many square inches does it contain?
13. How many rows of 7 square inches in it?
14. How many rows of 8 square inches in it?
15. One row of 7 square inches is what part of it?
16. Two rows of 7 square inches are what part of it?
17. One row of 8 square inches is what part of it?
18. Two rows of 8 square inches are what part of it?
19. How many rows of 7 squares equal $\frac{1}{2}$ of it?
20. How many rows of 7 squares equal $\frac{1}{4}$ of it?
21. Seven squares are what part of 14 squares?
22. Seven squares are what part of 21 squares?
23. Seven squares are what part of 28 squares?
24. Seven squares are what part of 35 squares?
25. Seven squares are what part of 42 squares?
26. Seven squares are what part of 49 squares?
27. Eight squares are what part of 16 squares?
28. Eight squares are what part of 24 squares?
29. Eight squares are what part of 32 squares?
30. Eight squares are what part of 40 squares?
31. Eight squares are what part of 48 squares?
32. Eight squares are what part of 56 squares?

1. With 1-inch cubes build a 4-inch square.
2. How many 1-inch cubes in the 4-inch square?
3. Place a second layer of 1-inch cubes on the first layer.
4. How many 1-inch cubes in both layers?
5. How many rows of four cubes in both layers?
6. Place a third layer on the second layer.
7. How many 1-inch cubes in the three layers?
8. How many rows of four cubes in the three layers?
9. Place a fourth layer on the third layer.
10. How many 1-inch cubes in the 4-inch cube?
11. One row is what part of one layer of cubes?
12. How many rows of four cubes in the 4-inch cube?
13. One row is what part of two layers?
14. One row is what part of three layers?
15. One row is what part of the 4-inch cube?
16. How many 1-inch cubes in $\frac{1}{2}$ of the 4-inch cube?
17. How many 1-inch cubes in $\frac{1}{4}$ of the 4-inch cube?
18. How many 1-inch cubes in $\frac{1}{8}$ of the 4-inch cube?
19. How many 1-inch cubes in $\frac{1}{16}$ of the 4-inch cube?
20. How many 2-inch squares in the 4-inch square?
21. Two rows are what part of one layer?
22. Two rows are what part of two layers?
23. Two rows are what part of three layers?
24. Two rows are what part of the 4-inch cube?
25. One layer is what part of the 4-inch cube?
26. Two layers are what part of the 4-inch cube?
27. Three layers are what part of the 4-inch cube?
28. Place the 64 cubes in a solid 8 inches long.
29. Place the 64 cubes in a solid 16 inches long.
30. Draw an 8-inch square. What is its perimeter?
31. How many 1-inch squares in it?
32. How many 4-inch cubes will cover it?

1. Memorize—

	4	4	4	4	4	4	4	4	4	4	4
	4	4	4	4	4	4	4	4	4	4	4
2×4= 8..	8	4	4	4	4	4	4	4	4	4	4
3×4=12.....		4	4	4	4	4	4	4	4	4	4
4×4=16.....			4	4	4	4	4	4	4	4	4
5×4=20.....				4	4	4	4	4	4	4	4
6×4=24.....					4	4	4	4	4	4	4
7×4=28.....						4	4	4	4	4	4
8×4=32.....							4	4	4	4	4
9×4=36.....								4	4	4	4
10×4=40.....									4	4	4
11×4=44.....											4
12×4=48.....											

State the sum of—

2.	3 and $\frac{1}{3}$ of 3.	**12.**	4 and $\frac{1}{4}$ of 4.
3.	4 and $\frac{1}{3}$ of 4.	**13.**	5 and $\frac{1}{4}$ of 5.
4.	5 and $\frac{1}{3}$ of 5.	**14.**	6 and $\frac{1}{4}$ of 6.
5.	6 and $\frac{1}{3}$ of 6.	**15.**	7 and $\frac{1}{4}$ of 7.
6.	7 and $\frac{1}{3}$ of 7.	**16.**	8 and $\frac{1}{4}$ of 8.
7.	8 and $\frac{1}{3}$ of 8.	**17.**	9 and $\frac{1}{4}$ of 9.
8.	9 and $\frac{1}{3}$ of 9.	**18.**	10 and $\frac{1}{4}$ of 10.
9.	10 and $\frac{1}{3}$ of 10.	**19.**	11 and $\frac{1}{4}$ of 11.
10.	11 and $\frac{1}{3}$ of 11.	**20.**	12 and $\frac{1}{4}$ of 12.
11.	12 and $\frac{1}{3}$ of 12.	**21.**	13 and $\frac{1}{4}$ of 13.

22.	**23.**	**24.**
2×22 =___	3×21 =___	$\frac{1}{3}$ of 30=___
2×23 =___	3×22 =___	$\frac{1}{3}$ of 33=___
2×24 =___	3×23 =___	$\frac{1}{3}$ of 36=___
2×22$\frac{1}{2}$=___	3×21$\frac{1}{3}$=___	$\frac{1}{3}$ of 39=___

1. At 5 cents a yard, what is the cost of 6 yards of ribbon?
2. At 5 cents each, what is the cost of 3 pencils?
3. At $4 a yard, what is the cost of 4 yards of cloth?
4. At $5 a yard, what is the cost of 5 yards of cloth?
5. At $6 a pair, what is the cost of 5 pairs of shoes?
6. At $5 a pair, what is the cost of 7 pairs of shoes?
7. How old is a man if $\frac{1}{6}$ of his age is 8 years?
8. How old is a man if $\frac{1}{7}$ of his age is 5 years?
9. What is the cost of 4 yards of cloth at $7 a yard?
10. What is the cost of 9 yards of cloth at $5 a yard?
11. What is the cost of 1 hat if 5 hats cost $20?
12. At $4 each, how many hats will $32 buy?
13. At $5 each, how many hats will $30 buy?
14. At $5 each, how many hats will $60 buy?
15. If 5 tons of coal cost $45, what is the price of 1 ton?
16. At $12 each, what will 5 coats cost?
17. A house has 5 rooms downstairs and 7 rooms upstairs. How many rooms in the house?
18. Of a school of 17 pupils, 5 were absent. How many were present?
19. Edwin bought a pencil for 5 cents and some pens for 4 cents. He gave 10 cents in payment. What should he get back?

State the results from dictation —

20. How many are 1 and 2 and 3 and 4?
21. How many are 7 and 3 and 5 and 2?
22. How many are 8 and 5 and 4 and 2?
23. How many are 9 and 4 and 3 and 5?
24. How many are 14 and 3 and 5 and 2?
25. How many are 6 and 5 and 4 less 2?
26. How many are 7 and 5 and 3 less 4?
27. How many are 8 and 4 and 3 less 5?

State the sums at sight—

1.	6	6	6	6	6	6	6	6	6
	10	30	60	90	20	40	70	80	50
2.	6	6	6	6	6	6	6	6	6
	41	21	31	11	91	71	61	51	81
3.	6	6	6	6	6	6	6	6	6
	22	12	52	42	32	62	92	82	72
4.	6	6	6	6	6	6	6	6	6
	93	63	33	13	23	53	83	43	73
5.	6	6	6	6	6	6	6	6	6
	84	94	54	44	34	24	14	64	74
6.	6	6	6	6	6	6	6	6	6
	65	45	25	35	15	55	95	85	75

Supply the missing number, which, added to the upper number, will give the lower—

7.	43	61	23	54	2	74
	?	?	?	?	?	?
	49	68	26	57	6	79
8.	81	11	32	97	45	21
	?	?	?	?	?	?
	85	16	38	99	47	29
9.	54	93	72	63	82	36
	?	?	?	?	?	?
	58	94	75	68	84	37

State the difference at sight—

1.	11	13	4	6	8	10	13	14	10	11
	6	5	3	2	1	8	9	5	9	3
2.	9	8	12	12	12	9	5	13	4	10
	4	8	5	9	6	4	5	4	2	1
3.	4	8	9	6	3	7	9	10	5	7
	4	2	6	1	2	5	3	7	4	3
4.	10	12	5	13	11	15	14	7	6	5
	6	3	2	8	5	6	5	7	0	3
5.	4	9	6	5	13	10	12	9	8	11
	1	2	4	1	7	3	4	1	3	7
6.	13	11	19	10	16	8	13	15	12	9
	9	2	5	9	15	3	3	13	10	5

Supply the missing number, which, taken from the upper number, leaves the lower—

7.	78	96	27	59	48	66	57	39	38	37
	?	?	?	?	?	?	?	?	?	?
	76	93	23	52	45	64	51	32	32	32
8.	8	39	87	19	34	53	9	27	97	87
	?	?	?	?	?	?	?	?	?	?
	4	33	82	14	31	51	2	20	91	84
9.	65	24	45	85	47	62	50	60	75	90
	?	?	?	?	?	?	?	?	?	?
	62	22	41	83	44	60	40	55	70	85

State the quotients at sight --

1.	8)40	5)40	4)28	6)30	12)48	4)12	3)24
2.	6)24	8)24	9)45	3)24	5)20	4)24	6)18
3.	4)16	6)30	8)32	9)45	2)18	9)36	3)27
4.	5)45	7)35	3)21	2)16	10)40	5)25	9)27
5.	7)14	4)48	3)12	5)15	2)14	6)6	4)32
6	3)3	2)12	9)18	8)16	7)28	5)60	7)7
7.	4)36	3)9	8)16	12)36	2)10	6)12	3)15
8.	9)9	5)20	7)35	8)32	9)18	5)25	4)28
9.	3)15	6)24	11)55	7)28	5)25	3)12	7)21
10.	11)44	12)60	5)10	4)20	12)48	3)18	12)24
11.	7)35	8)32	6)24	5)15	11)55	12)48	10)50
12.	6)180	7)420	4)420	4)480	6)546	6)726	
13.	7)210	5)350	7)497	4)280	7)847	7)707	
14.	8)640	4)408	8)320	12)960	8)808	8)728	
15.	9)450	6)540	9)909	9)918	9)945	9)972	

1. Write the number ten.
2. What does the figure at the right show?
3. What does the figure at the left show?
4. How is the number ten changed to eleven?
5. What name is given to the right-hand column?
6. How are two tens written? How read?
7. What figure of a number shows how many tens?
8. What name is given to three tens? To five tens?
9. How many figures are required to write ten tens?
10. What name is given to ten tens?
11. How are five hundreds written? Ten hundreds?
12. What name is given to ten hundreds?
13. What name is given to the right-hand column?
14. What name is given to the second place from the right?
15. What name is given to the third place from the right?
16. What name is given to the fourth place from the right?

Write the numbers—

17. Twenty-five.
18. Two hundred three.
19. One hundred fifty-five.
20. Two hundred two.
21. Nine hundred one.
22. Six hundred forty.
23. Eight hundred seventy.
24. One hundred sixty-nine.
25. One thousand two hundred.
26. One thousand twenty.

Read the numbers—

27. 240
28. 204
29. 400
30. 402
31. 789
32. 897
33. 909
34. 1100
35. 1001
36. 1101
37. 1110
38. 1010
39. 1011
40. 1111
41. 2007
42. 3018
43. 2120
44. 3414
45. 2639
46. 8877
47. 1708

1. Memorize—

	5	5	5	5	5	5	5	5	5	5	5
	5	5	5	5	5	5	5	5	5	5	5
$2\times5=10$	10	5	5	5	5	5	5	5	5	5	5
$3\times5=15$		5	5	5	5	5	5	5	5	5	5
$4\times5=20$			5	5	5	5	5	5	5	5	5
$5\times5=25$				5	5	5	5	5	5	5	5
$6\times5=30$					5	5	5	5	5	5	5
$7\times5=35$						5	5	5	5	5	5
$8\times5=40$							5	5	5	5	5
$9\times5=45$								5	5	5	5
$10\times5=50$									5	5	5
$11\times5=55$											5
$12\times5=60$											

2. 1 ten and 5 units = ___ units.
3. 2 tens and 5 units = ___ units.
4. 3 tens and 5 units = ___ units.
5. 4 tens and 5 units = ___ units.
6. 5 tens and 5 units = ___ units.
7. 5 dimes and 5 cents + 5 dimes and 5 cents = ___ cents.
8. 5 dimes and 6 cents + 5 dimes and 6 cents = ___ cents.
9. 5 dimes and 7 cents + 5 dimes and 3 cents = ___ cents.
10. 5 dimes and 8 cents + 5 dimes and 7 cents = ___ cents.
11. 5 dimes and 9 cents + 5 dimes and 6 cents = ___ cents.

12. Write from dictation—

\$1.10	\$25.10	\$30.10	\$50.00
2.25	35.25	35.20	50.50
3.50	45.75	40.20	75.50
5.00	.50	1.50	6.90
6.60	8.80	67.90	95.95

1. 25 equals___tens and___units.
2. 36 equals___tens and___units.
3. 47 equals___tens and___units.
4. 58 equals___tens and___units.
5. 69 equals___tens and___units.
6. 70 equals___tens and___units.

7. 1 hundred, 2 tens, and 3 units equal___.
8. 2 hundreds, 3 tens, and 4 units equal___.
9. 3 hundreds, 4 tens, and 5 units equal___.
10. 5 hundreds, 0 tens, and 0 units equal___.
11. 8 hundreds, 9 tens, and 5 units equal___.
12. 9 hundreds, 0 tens, and 6 units equal___.

13. 125 equals___hundred, ___tens, ___units.
14. 236 equals___hundreds, ___tens, ___units.
15. 347 equals___hundreds, ___tens, ___units.
16. 458 equals___hundreds, ___tens, ___units.

17. $1.10 equal one dollar and one dime.
18. $1.25 equal___dollar, ___dimes, and___cents.
19. $2.35 equal___dollars, ___dimes, and___cents.
20. $4.75 equal___dollars, ___dimes, and___cents.
21. $5.25 equal___dollars, ___dimes, and___cents.
22. $8.45 equal___dollars, ___dimes, and___cents.

23. 120 cents equal_dollar, _dimes, and_cents.
24. 233⅓ cents equal_dollars, _dimes, and_cents.
25. 375 cents equal_dollars, _dimes, and_cents.
26. 412½ cents equal_dollars, _dimes, and_cents.
27. 550 cents equal_dollars, _dimes, and_cents.
28. 737½ cents equal_dollars, _dimes, and_cents.

1. 2 times 1 ft. 6 in. are____.
2. 3 times 2 ft. 4 in. are____.
3. 4 times 3 ft. 3 in. are____.
4. 4 times 2 ft. 6 in. are____.
5. 6 times 2 ft. 2 in. are____.
6. 8 times 1 ft. 3 in. are____.
7. 3 times 1 yd. 1 ft. are____.
8. 6 times 1 yd. 1 ft. are____.
9. 3 times 2 yd. 1 ft. are____.
10. 4 times 3 yd. 1 ft. are____.
11. 2 times 4 yd. 1½ ft. are____.
12. 4 times 2 yd. 2¼ ft. are____.

13. ½ of 4 feet 4 inches equals____feet____inches.
14. ½ of 5 feet equals____feet____inches.
15. ½ of 6 feet 6 inches equals____feet____inches.
16. ½ of 7 feet equals____feet____inches.
17. ½ of 7 feet 6 inches equals____feet____inches.
18. ½ of 1 yard equals____feet____inches.
19. ½ of 5 yards equals____feet____inches.

20. ½ of 40=____.
21. ½ of 60=____.
22. ½ of 80=____.
23. ½ of 100=____.
24. ½ of 140=____.
25. ½ of 160=____.
26. ½ of 180=____.
27. ½ of 200=____.
28. ½ of 220=____.
29. ½ of 240=____.
30. ⅓ of 30=____.
31. ⅓ of 60=____.
32. ⅓ of 90=____.
33. ⅓ of 120=____.
34. ⅓ of 180=____.
35. ⅓ of 210=____.
36. ⅓ of 240=____.
37. ⅓ of 270=____.
38. ⅓ of 300=____.
39. ⅓ of 330=____.
40. ¼ of 40=____.
41. ¼ of 80=____.
42. ¼ of 120=____.
43. ¼ of 160=____.
44. ¼ of 240=____.
45. ¼ of 280=____.
46. ¼ of 320=____.
47. ¼ of 360=____.
48. ¼ of 400=____.
49. ¼ of 440=____.

50. 50+60 equals____.
51. 60+80 equals____.
52. 70—40 equals____.
53. 80+30 equals____.
54. 90—50 equals____.
55. 40+90 equals____.
56. 40+60—30 equals____.
57. 50+30+50 equals____.
58. 60+90—70 equals____.
59. 70—10+90 equals____.
60. 80—70+40 equals____.
61. 90+50—60 equals____.

1. Memorize—

4 gills make 1 pint.
2 pints make 1 quart.
4 quarts make 1 gallon.

2. How many gills in a quart?
3. How many gills in a gallon?
4. What part of a gallon is one gill?
5. What part of a gallon is one pint?
6. What part of a gallon is one quart?
7. How many gills in one half of a gallon?
8. How many gills in one fourth of a gallon?
9. How many gills in one eighth of a gallon?
10. How many gills in 1 pint, 1 gill?
11. How many gills in 1 quart, 1 pint?
12. How many gills in 2 quarts, 2 pints?
13. How many gills in 3 quarts, 3 pints?
14. How many gills in 4 quarts, 1 pint, 2 gills?
15. How many gills in 5 quarts, 1 pint, 3 gills?
16. One quart less 1 gill =___pt., ___gills.
17. One quart less 3 gills =___pt., ___gills.
18. One gallon less 1 pint =___qt., ___pt.
19. One gallon less 3 pints=___qt., ___pt.
20. How many pints in $1\frac{1}{2}$ gallons?
21. How many gallons in 12 pints?
22. How many quarts in $2\frac{1}{2}$ gallons?
23. How many pints in 1 gal., 1 qt., 1 pt.?
24. How many pints in 2 gal., 2 qt., 1 pt.?
25. How many pints in 3 gal., 3 qt., 1 pt.?

26. 300+600=___ 28. 600+70=___ 30. 300+45=___
27. 400+500=___ 29. 700+60=___ 31. 400+56=___

1. One half of 12 and one sixth of 12 are how many?
2. One third of 12 and one sixth of 12 are how many?
3. One fourth of 12 and one sixth of 12 are how many?
4. One sixth of 18 and one ninth of 18 are how many?
5. One third of 18 and one half of 18 are how many?

6. $\frac{1}{3}$ of $15+\frac{1}{5}$ of 15=___.
7. $\frac{1}{2}$ of $20+\frac{1}{4}$ of 20=___.
8. $\frac{1}{2}$ of $20+\frac{1}{5}$ of 20=___.
9. $\frac{1}{4}$ of $20+\frac{1}{5}$ of 20=___.
10. $\frac{1}{3}$ of $18+\frac{1}{6}$ of 18=___.
11. $\frac{1}{3}$ of $6+\frac{1}{2}$ of 6=___.
12. $\frac{1}{2}$ of $8+\frac{1}{4}$ of 8=___.
13. $\frac{1}{2}$ of $12+\frac{1}{3}$ of 12=___.
14. $\frac{1}{2}$ of $12+\frac{1}{4}$ of 12=___.
15. $\frac{1}{3}$ of $12+\frac{1}{4}$ of 12=___.

16. $\frac{1}{2}$ of $12+\frac{1}{3}$ of $12+\frac{1}{4}$ of 12 are how many?
17. $\frac{1}{2}$ of $6+\frac{1}{4}$ of $8+\frac{1}{5}$ of 10 are how many?
18. $\frac{1}{2}$ of $10+\frac{1}{4}$ of $16+\frac{1}{5}$ of 20 are how many?

19. One half of 24 and one third of 24 equal___.
20. One third of 24 and one sixth of 24 equal___.
21. One fourth of 24 and one eighth of 24 equal___.
22. Two thirds of 24 and three fourths of 24 equal___.
23. Five sixths of 24 and five twelfths of 24 equal___.
24. One twelfth of 24 and two thirds of 24 equal___.
25. One half of 24 and one sixth of 24 equal___.
26. One half of 24 and one eighth of 24 equal___.
27. One half of 24 and one twelfth of 24 equal___.
28. One third of 24 and one fourth of 24 equal___.
29. One third of 24 and one eighth of 24 equal___.
30. One third of 24 and one twelfth of 24 equal___.
31. One fourth of 24 and one sixth of 24 equal___.
32. One fourth of 24 and one twelfth of 24 equal___.
33. One sixth of 24 and one eighth of 24 equal___.
34. One sixth of 24 and two thirds of 24 equal___.

1. 6+6+5+3=____
2. 6+5+6+6=____
3. 9+6+4+2=____
4. 8+6+3+4=____
5. 7+6+4+5=____
6. 8+7+6+5=____
7. 1+4+7+9=____
8. 12+6+5+6=____
9. 12+5+3+6=____
10. 19+4+6+3=____
11. 20+4+3+6=____
12. 14+3+5+9=____
13. 13+9+5+4=____
14. 20+9+8+6=____

Add —

15.	**16.**	**17.**	**18.**	**19.**	**20.**	**21.**	**22.**
8	6	7	6	4	3	7	5
9	7	8	9	7	7	2	5
5	4	2	2	9	8	9	8
4	9	9	8	9	2	1	7
7	3	6	6	6	9	8	9
6	7	7	4	8	6	6	6
8	8	6	9	4	5	4	4

23.	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
12	13	14	15	16	26	27	27
13	13	13	14	14	14	14	15

31.	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**
19	17	28	17	26	26	39	27
32	35	17	16	15	30	29	19
24	22	16	19	31	27	19	18

39.	**40.**	**41.**
2 gal. 2 qt.	3 ft. 5 in.	4 pk. 3 qt.
2 gal. 1 qt.	2 ft. 4 in.	3 pk. 4 qt.
2 gal. 1 qt.	3 ft. 3 in.	5 pk. 1 qt.

Subtract, first the tens, then the units—

1. 20—12=___	**9.** 20—18=___	**17.** 31—12=___
2. 30—14=___	**10.** 50—24=___	**18.** 42—16=___
3. 40—16=___	**11.** 40—33=___	**19.** 53—18=___
4. 60—18=___	**12.** 60—43=___	**20.** 95—15=___
5. 70—13=___	**13.** 30—24=___	**21.** 75—19=___
6. 80—15=___	**14.** 90—42=___	**22.** 86—17=___
7. 90—17=___	**15.** 70—21=___	**23.** 97—18=___
8. 100—19=___	**16.** 100—36=___	**24.** 99—27=___

Subtract, first the hundreds, then the tens—

25. 400—240=___	**29.** 800—420=___	**33.** 500—180=___
26. 600—130=___	**30.** 500—450=___	**34.** 400—290=___
27. 800—320=___	**31.** 700—260=___	**35.** 600—370=___
28. 600—280=___	**32.** 800—370=___	**36.** 900—580=___

Subtract—

37.	**38.**	**39.**	**40.**	**41.**
12	15	13	14	16
7	8	6	9	7
42.	**43.**	**44.**	**45.**	**46.**
112	115	113	114	116
7	6	6	9	7
47.	**48.**	**49.**	**50.**	**51.**
432	543	654	765	753
123	234	345	456	444
52.	**53.**	**54.**	**55.**	**56.**
876	987	742	853	631
567	678	738	349	127

1. One half of a pound equals $\frac{1}{3}$ of____ounces.
2. One half of a pound equals $\frac{1}{4}$ of____ounces.
3. One fourth of a pound equals $\frac{1}{2}$ of____ounces.
4. One fourth of a pound equals $\frac{1}{3}$ of____ounces.
5. One half of a pound equals $\frac{1}{5}$ of____ounces.
6. One half of a pound equals $\frac{1}{6}$ of____ounces.
7. One fourth of a pound equals $\frac{1}{5}$ of____ounces.
8. One fourth of a pound equals $\frac{1}{6}$ of____ounces.
9. One eighth of a pound equals $\frac{1}{2}$ of____ounces.
10. One eighth of a pound equals $\frac{1}{3}$ of____ounces.
11. One eighth of a pound equals $\frac{1}{4}$ of____ounces.
12. One eighth of a pound equals $\frac{1}{5}$ of____ounces.
13. One eighth of a pound equals $\frac{1}{6}$ of____ounces.
14. One fourth of a pound equals $\frac{1}{8}$ of____ounces.
15. One fourth of a pound equals $\frac{1}{9}$ of____ounces.
16. One fourth of a pound equals $\frac{1}{10}$ of____ounces.
17. One fourth of a pound equals $\frac{1}{11}$ of____ounces.
18. One fourth of a pound equals $\frac{1}{12}$ of____ounces.

19. One half of a month equals one third of____days.
20. One third of a month equals one half of____days.
21. One third of a month equals one fifth of____days.
22. One third of a month equals one sixth of____days.
23. One fifth of a month equals one half of____days.
24. One fifth of a month equals one third of____days.
25. One fifth of a month equals one fourth of____days.
26. One fifth of a month equals one sixth of____days.
27. One fifth of a month equals one seventh of____days.
28. One sixth of a month equals one half of____days.
29. One sixth of a month equals one third of____days.
30. One sixth of a month equals one fourth of____days.
31. One sixth of a month equals one fifth of____days.

1. One half of 24 hours equals one third of___hours.
2. One third of 24 hours equals one half of___hours.
3. One half of 24 hours equals one fourth of___hours.
4. One fourth of 24 hours equals one half of___hours.
5. One fourth of 24 hours equals one third of___hours.
6. One sixth of 24 hours equals one half of___hours.
7. One sixth of 24 hours equals one third of___hours.
8. One sixth of 24 hours equals one fourth of___hours.
9. One half of 24 hours equals one sixth of___hours.
10. One third of 24 hours equals one sixth of___hours.
11. One fourth of 24 hours equals one sixth of___hours.

12. One fourth of a yard equals one half of___inches.
13. One fourth of a yard equals one third of___inches.
14. One half of a yard equals one third of___inches.
15. One third of a yard equals one half of___inches.
16. One third of a yard equals one fourth of___inches.
17. One third of a yard equals one sixth of___inches.
18. One fourth of a yard equals one sixth of___inches.
19. One sixth of a yard equals one third of___inches.
20. One sixth of a yard equals one fourth of___inches.
21. One sixth of a yard equals one half of___inches.
22. One ninth of a yard equals one half of___inches.
23. One ninth of a yard equals one third of___inches.
24. One ninth of a yard equals one fourth of___inches.
25. One ninth of a yard equals one fifth of___inches.
26. One ninth of a yard equals one sixth of___inches.
27. One twelfth of a yard equals one half of___inches.
28. One twelfth of a yard equals one third of___inches.
29. One twelfth of a yard equals one fourth of___inches.
30. One twelfth of a yard equals one fifth of___inches.
31. One twelfth of a yard equals one sixth of___inches.

1. Memorize—

	6	6	6	6	6	6	6	6	6	6	6
	6	6	6	6	6	6	6	6	6	6	6
$2\times6=12$	12	6	6	6	6	6	6	6	6	6	6
$3\times6=18$		6	6	6	6	6	6	6	6	6	6
$4\times6=24$			6	6	6	6	6	6	6	6	6
$5\times6=30$				6	6	6	6	6	6	6	6
$6\times6=36$					6	6	6	6	6	6	6
$7\times6=42$						6	6	6	6	6	6
$8\times6=48$							6	6	6	6	6
$9\times6=54$								6	6	6	6
$10\times6=60$									6	6	6
$11\times6=66$										6	6
$12\times6=72$											

2. Count by 7's from 7 to 70, and back from 70 to 7.
3. Count by 8's from 8 to 80, and back from 80 to 8.
4. Count by 8's from 7 to 79, and back from 79 to 7.
5. Count by 8's from 6 to 78, and back from 78 to 6.
6. Count by 8's from 5 to 77, and back from 77 to 5.
7. Count by 8's from 4 to 76, and back from 76 to 4.
8. Count by 8's from 3 to 75, and back from 75 to 3.
9. Count by 8's from 2 to 74, and back from 74 to 2.
10. Count by 8's from 1 to 73, and back from 73 to 1.
11. How many days in $\frac{1}{6}$ of a month + $\frac{3}{6}$ of a month?
12. How many hours in $\frac{1}{6}$ of a day + $\frac{3}{6}$ of a day?
13. How many minutes in $\frac{1}{6}$ of an hour + $\frac{3}{6}$ of an hour?
14. How many days in $\frac{2}{6}$ of a month + $\frac{5}{6}$ of a month?
15. How many hours in $\frac{3}{6}$ of a day + $\frac{5}{6}$ of a day?
16. How many minutes in $\frac{5}{6}$ of an hour — $\frac{1}{6}$ of an hour?
17. How many inches in $\frac{1}{6}$ of a yard + $\frac{4}{6}$ of a yard?
18. How many inches in $\frac{5}{6}$ of a yard — $\frac{1}{6}$ of a yard?

1. Memorize—

2 pints make 1 quart.
8 quarts make 1 peck.
4 pecks make 1 bushel.

2. How many pints in one peck?
3. How many pints in one and one half pecks?
4. How many quarts in one and one half pecks?
5. How many quarts in one bushel?
6. How many quarts in one half of a bushel?
7. How many quarts in one and one half bushels?
8. How many quarts in two and one half pecks?
9. How many pints in one bushel?
10. A pint is what part of a quart? Of two quarts?
11. A pint is what part of a peck? Of one half-peck?
12. A pint is what part of a bushel? Of one half-bushel?

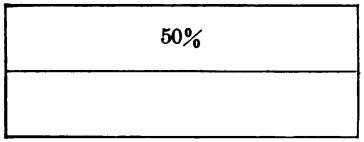
13. Memorize—

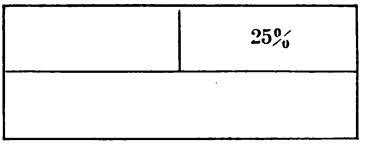
1 bushel of oats weighs 32 pounds.
1 bushel of wheat weighs 60 pounds.

14. What is the weight of one peck of oats?
15. What is the weight of one half of a bushel of oats?
16. What is the weight of one half of a peck of oats?
17. What is the weight of one quart of oats?
18. What is the weight of one peck of wheat?
19. How many pounds in 2 bushels of oats?
20. How many pounds in $1\frac{1}{2}$ bushels of oats?
21. How many pounds in $1\frac{1}{4}$ bushels of oats?
22. How many pounds in $2\frac{1}{4}$ bushels of oats?
23. How many pounds in $1\frac{1}{2}$ bushels of wheat?
24. How many pounds in $2\frac{1}{2}$ bushels of wheat?

1. How many cents in one dollar?
2. How many cents in one half of a dollar?
3. How many cents in one fourth of a dollar?
4. What part of a dollar is one cent? Are fifty cents? Are twenty-five cents?

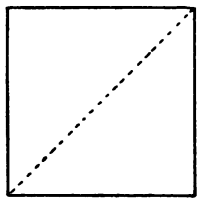
In making comparisons based on one hundred, the words *per cent* are used. As 1 cent is $\frac{1}{100}$ of a dollar, it is also 1 *per cent* of a dollar. As 50 cents are $\frac{50}{100}$ of a dollar, it is also 50 *per cent* of a dollar. As a half-dollar is 50 *per cent* of a dollar, so one half of anything is 50 *per cent* of it; one fourth of anything is 25 *per cent* of it. The whole of anything is 100 *per cent* of itself.



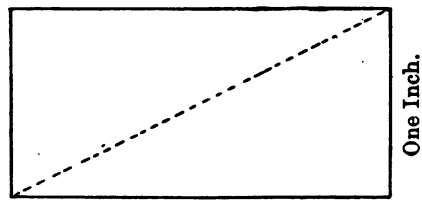


Notice how 50 per cent is written in the figure.

5. What part of the figure is 50% of it? Is 25% of it?
6. What is 50% of 10 pencils? Of 20 books?
7. What is 25% of 40 boys? Of 100 girls?
8. What is 25% of a year? Of a day? Of an hour?
9. What is 50% of a year? Of a day? Of an hour?
10. How many months in 25% of 1 year 4 months?
11. How many months in 25% of 2 years 4 months?
12. How many months in 50% of 1 year 6 months?
13. How many months in 50% of 2 years 8 months?
14. How many ounces in 25% of 1 pound 8 ounces?
15. How many ounces in 50% of 2 pounds 12 ounces?
16. How many pounds in 25% of a bushel of oats?
17. How many pounds in 50% of a bushel of oats?



A Square Inch.

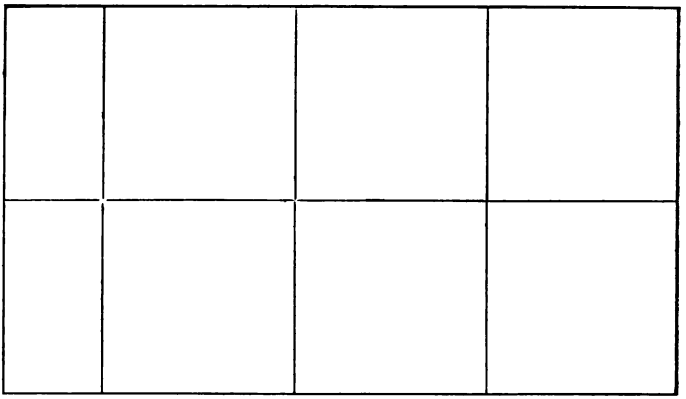


Two Inches.

1. Cut from paper a 4-inch square.
2. Draw a diagonal and make two triangles.
3. Are the two triangles equal?
4. What part of the square is each triangle?
5. What is the area of the square?
6. What is the area of each triangle?
7. Cut from paper a rectangle 3 in. wide and 4 in. long.
8. Draw a diagonal and make two triangles.
9. What is the area of the rectangle?
10. What is the area of each triangle?
11. What is the base of each triangle?
12. What is the altitude of each triangle?

Draw and find the area of a triangle having—

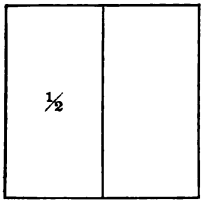
13. An altitude of 6 inches and a base of 4 inches.
14. An altitude of 6 inches and a base of 6 inches.
15. An altitude of 8 inches and a base of 6 inches.
16. An altitude of 10 inches and a base of 6 inches.
17. An altitude of 10 inches and a base of 8 inches.
18. An altitude of 9 inches and a base of 4 inches.
19. An altitude of 9 inches and a base of 6 inches.
20. An altitude of 10 inches and a base of 9 inches.
21. An altitude of 12 inches and a base of 8 inches.
22. An altitude of 9 inches and a base of 12 inches.

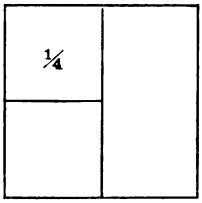


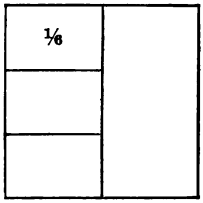
1. How many square inches in this rectangle?

Draw and find the area of—

2. A rectangle 2 inches wide and $3\frac{1}{2}$ inches long.
3. A rectangle 2 inches wide and $5\frac{1}{2}$ inches long.
4. A rectangle $2\frac{1}{2}$ inches wide and 4 inches long.
5. A rectangle $2\frac{1}{2}$ inches wide and 6 inches long.
6. A rectangle $2\frac{1}{2}$ inches wide and 8 inches long.
7. A rectangle 2 inches wide and $6\frac{1}{2}$ inches long.
8. A rectangle 2 inches wide and $8\frac{1}{2}$ inches long.
9. A rectangle $3\frac{1}{2}$ inches wide and 6 inches long.
10. A rectangle $3\frac{1}{2}$ inches wide and 8 inches long.
11. A rectangle 4 inches wide and $5\frac{1}{2}$ inches long.
12. A rectangle 4 inches wide and $6\frac{1}{2}$ inches long.
13. A rectangle $4\frac{1}{2}$ inches wide and 6 inches long.
14. A rectangle $4\frac{1}{2}$ inches wide and 8 inches long.
15. A rectangle $5\frac{1}{2}$ inches wide and 6 inches long.
16. A rectangle $5\frac{1}{2}$ inches wide and 8 inches long.
17. A rectangle $4\frac{1}{2}$ inches wide and 10 inches long.
18. A rectangle $5\frac{1}{2}$ inches wide and 10 inches long.

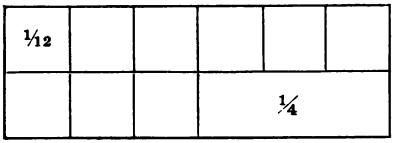




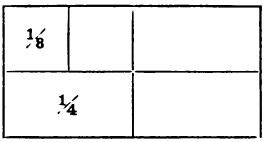


1. How many halves in any quantity?
2. How many fourths in any quantity?
3. How many fourths in one half?
4. One half and one half are how many fourths?
5. One half and one fourth are how many fourths?
6. One half less one fourth equals what?
7. One half of one half equals what?
8. How many sixths in the whole of any quantity?
9. How many sixths in one half of any quantity?
10. What is the sum of one half and one sixth?
11. What is the difference between one half and one sixth?
12. What is one third of one half?
13. How many sixths in one third and one half?
14. How many sixths in two thirds less one half?
15. One half and one third are how many sixths?

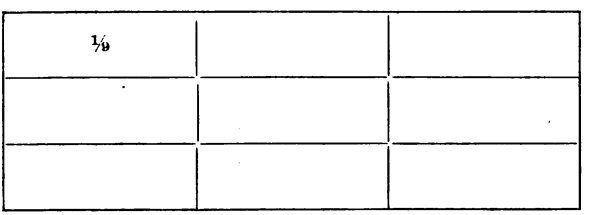
16. $\frac{1}{2}+\frac{1}{2}=$___
17. $\frac{1}{3}+\frac{1}{3}=$___
18. $\frac{1}{3}+\frac{2}{3}=$___
19. $\frac{2}{3}+\frac{2}{3}=$___
20. $\frac{1}{2}+\frac{1}{3}=$___
21. $\frac{1}{2}+\frac{2}{3}=$___
22. $\frac{1}{2}-\frac{1}{3}=$___
23. $\frac{2}{3}-\frac{1}{2}=$___
24. $\frac{3}{6}-\frac{1}{3}=$___
25. $1-\frac{1}{2}=$___
26. $1-\frac{1}{3}=$___
27. $1-\frac{2}{3}=$___
28. $1-\frac{1}{4}=$___
29. $1-\frac{2}{4}=$___
30. $1-\frac{3}{4}=$___
31. $\frac{1}{2}+\frac{1}{4}=$___
32. $\frac{1}{2}-\frac{1}{4}=$___
33. $\frac{3}{4}-\frac{1}{2}=$___
34. $\frac{1}{2}+\frac{1}{6}=$___
35. $\frac{1}{2}-\frac{1}{6}=$___
36. $\frac{1}{3}-\frac{1}{6}=$___
37. $\frac{1}{3}+\frac{1}{6}=$___
38. $\frac{2}{3}-\frac{1}{6}=$___
39. $\frac{2}{3}+\frac{1}{6}=$___
40. $\frac{5}{6}-\frac{1}{3}=$___
41. $\frac{5}{6}-\frac{1}{2}=$___
42. $\frac{3}{6}+\frac{1}{2}=$___



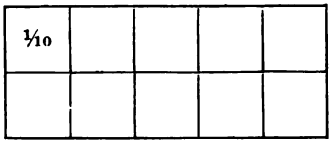
1. How many twelfths in this figure?
2. How many twelfths in $\frac{1}{2}$ of the figure?
3. How many twelfths in $\frac{1}{3}$ of the figure?
4. How many twelfths in $\frac{1}{4}$ of the figure?
5. How many twelfths in $\frac{1}{6}$ of the figure?
6. One half and one third are how many twelfths?
7. One half and one sixth are how many twelfths?
8. One fourth and one sixth are how many twelfths?
9. One third and one sixth are how many twelfths?
10. One half less one third equals what?
11. One half less one fourth equals what?
12. One half less one sixth equals what?
13. One half less one twelfth equals what?
14. One third less one fourth equals what?
15. One third less one sixth equals what?
16. One third less one twelfth equals what?
17. One fourth less one sixth equals what?
18. One fourth less one twelfth equals what?
19. How many twelfths in $\frac{2}{3}$? In $\frac{2}{4}$? In $\frac{3}{4}$?
20. How many twelfths in $\frac{1}{2} + \frac{1}{3} - \frac{1}{4}$?
21. How many twelfths in $\frac{3}{4} + \frac{2}{3} - \frac{1}{2}$?
22. How many twelfths in $\frac{3}{4} - \frac{1}{3} + \frac{1}{2}$?
23. How many twelfths in $\frac{3}{4} - \frac{2}{3} + \frac{1}{2}$?
24. How many twelfths in $\frac{3}{4} - \frac{1}{12} + \frac{1}{6}$?
25. How many twelfths in $\frac{1}{4} + \frac{5}{12} - \frac{1}{3}$?
26. How many twelfths in $\frac{1}{3} + \frac{5}{12} - \frac{1}{4}$?
27. How many twelfths in $\frac{5}{12} - \frac{1}{4} + \frac{1}{6}$?



1. How many eighths in $\frac{1}{4}$? In $\frac{1}{2}$?
2. How many eighths in $\frac{1}{2}+\frac{1}{4}$? In $\frac{1}{2}-\frac{1}{4}$?
3. How many eighths in $\frac{1}{2}+\frac{1}{8}$? In $\frac{1}{2}+\frac{1}{8}-\frac{1}{4}$?
4. How many eighths in $\frac{1}{8}+\frac{1}{4}$? In $\frac{1}{8}+\frac{1}{4}+\frac{1}{2}$?
5. How many eighths in $\frac{1}{2}-\frac{1}{8}$? In $\frac{1}{2}-\frac{1}{8}+\frac{1}{4}$?
6. How many eighths in $\frac{1}{4}-\frac{1}{8}$? In $\frac{1}{4}-\frac{1}{8}+\frac{1}{2}$?
7. How many eighths in $\frac{3}{8}+\frac{1}{4}$? In $\frac{3}{8}+\frac{1}{4}-\frac{1}{2}$?
8. How many eighths in $\frac{3}{8}-\frac{1}{4}$? In $\frac{3}{8}-\frac{1}{4}+\frac{1}{2}$?
9. How many eighths in $\frac{3}{4}+\frac{1}{8}$? In $\frac{3}{4}+\frac{1}{8}-\frac{1}{2}$?
10. How many eighths in $\frac{5}{8}-\frac{1}{2}$? In $\frac{5}{8}-\frac{1}{2}+\frac{1}{4}$?
11. How many eighths in $\frac{3}{4}-\frac{3}{8}$? In $\frac{3}{4}-\frac{3}{8}+\frac{1}{2}$?
12. How many eighths in $\frac{5}{8}-\frac{1}{2}$? In $\frac{5}{8}-\frac{1}{2}+\frac{1}{4}$?



13. How many ninths in $\frac{1}{3}$? In $\frac{2}{3}$?
14. How many ninths in $\frac{1}{3}+\frac{1}{9}$? In $\frac{2}{3}+\frac{1}{9}$?
15. How many ninths in $\frac{1}{3}-\frac{1}{9}$? In $\frac{2}{3}-\frac{1}{9}$?
16. How many ninths in $1-\frac{1}{3}$? In $1-\frac{1}{3}+\frac{1}{9}$?
17. How many ninths in $1+\frac{1}{3}$? In $1+\frac{1}{3}-\frac{1}{9}$?
18. How many ninths in $1-\frac{2}{3}$? In $1-\frac{2}{3}-\frac{1}{9}$?
19. How many ninths in $1-\frac{5}{9}$? In $1-\frac{5}{9}-\frac{1}{3}$?
20. How many ninths in $1+\frac{2}{3}$? In $1+\frac{2}{3}-\frac{1}{9}$?



1. How many tenths in 1? In $\frac{1}{2}$? In $\frac{1}{5}$?
2. How many tenths in $\frac{1}{2}+\frac{1}{5}$?
3. How many tenths in $\frac{1}{2}+\frac{1}{10}-\frac{1}{5}$?
4. How many tenths in $\frac{1}{2}+\frac{1}{5}+\frac{1}{10}$?
5. How many tenths in $\frac{1}{2}+\frac{1}{5}-\frac{1}{10}$?
6. How many tenths in $\frac{1}{2}-\frac{2}{5}-\frac{1}{10}$?
7. How many tenths in $\frac{3}{5}-\frac{1}{2}+\frac{1}{10}$?
8. How many tenths in $\frac{2}{5}+\frac{1}{2}-\frac{3}{10}$?
9. How many tenths in $\frac{1}{2}-\frac{2}{5}+\frac{1}{10}$?
10. How many tenths in $\frac{3}{5}-\frac{1}{2}-\frac{1}{10}$?
11. How many tenths in $\frac{1}{2}+\frac{4}{5}-\frac{9}{10}$?

12. Count by $1\frac{1}{2}$ from $1\frac{1}{2}$ to 30, and back from 30 to $1\frac{1}{2}$.
13. Count by $1\frac{1}{8}$ from $1\frac{1}{8}$ to 32, and back from 32 to $1\frac{1}{8}$.
14. Count by $1\frac{1}{4}$ from $1\frac{1}{4}$ to 30, and back from 30 to $1\frac{1}{4}$.
15. Count by $1\frac{1}{5}$ from $1\frac{1}{5}$ to 30, and back from 30 to $1\frac{1}{5}$.
16. Count by $1\frac{1}{6}$ from $1\frac{1}{6}$ to 28, and back from 28 to $1\frac{1}{6}$.
17. Count by $2\frac{1}{2}$ from $2\frac{1}{2}$ to 30, and back from 30 to $2\frac{1}{2}$.
18. Count by $2\frac{1}{8}$ from $2\frac{1}{8}$ to 21, and back from 21 to $2\frac{1}{8}$.
19. Count by $2\frac{1}{4}$ from $2\frac{1}{4}$ to 27, and back from 27 to $2\frac{1}{4}$.
20. Count by $2\frac{1}{5}$ from $2\frac{1}{5}$ to 22, and back from 22 to $2\frac{1}{5}$.

21. $10\frac{1}{2}+20\frac{1}{2}=$
22. $12\frac{1}{2}+12\frac{1}{8}=$
23. $15\frac{1}{2}+15\frac{1}{4}=$
24. $20\frac{1}{2}+21\frac{1}{5}=$
25. $16\frac{1}{8}+16\frac{1}{4}=$
26. $25\frac{1}{2}-15\frac{1}{4}=$
27. $35\frac{1}{8}-25\frac{1}{6}=$
28. $35\frac{1}{4}-15\frac{1}{8}=$
29. $24\frac{1}{5}-14\frac{1}{10}=$
30. $36\frac{3}{5}-12\frac{1}{2}=$

1. Develop the multiplication table for 7. (See pages 21, 36, and 37.)

2. Memorize—

$2\times7=14$	2 is one seventh of____.
$3\times7=21$	3 is one seventh of____.
$4\times7=28$	4 is one seventh of____.
$5\times7=35$	5 is one seventh of____.
$6\times7=42$	6 is one seventh of____.
$7\times7=49$	7 is one seventh of____.
$8\times7=56$	8 is one seventh of____.
$9\times7=63$	9 is one seventh of____.
$10\times7=70$	10 is one seventh of____.
$11\times7=77$	11 is one seventh of____.
$12\times7=84$	12 is one seventh of____.

3. One third of 21 and $\frac{1}{7}$ of 21 are how many?
4. One half of 28 and $\frac{1}{4}$ of 28 are how many?
5. One half of 28 and $\frac{1}{7}$ of 28 are how many?
6. One fourth of 28 and $\frac{1}{7}$ of 28 are how many?
7. One fifth of 35 and $\frac{1}{7}$ of 35 are how many?
8. One half of 42 and $\frac{1}{6}$ of 42 are how many?
9. One half of 42 and $\frac{1}{7}$ of 42 are how many?
10. One third of 42 and $\frac{1}{6}$ of 42 are how many?
11. One third of 42 and $\frac{1}{7}$ of 42 are how many?
12. One sixth of 42 and $\frac{1}{7}$ of 42 are how many?
13. One seventh of 49 and $\frac{1}{7}$ of 42 are how many?
14. One seventh of 49 and $\frac{1}{7}$ of 56 are how many?
15. One seventh of 56 and $\frac{1}{8}$ of 56 are how many?
16. One seventh of 63 and $\frac{1}{9}$ of 63 are how many?
17. One seventh of 63 and $\frac{1}{7}$ of 70 are how many?
18. One seventh of 56 and $\frac{1}{7}$ of 77 are how many?

1. Develop the multiplication table for 8.

2. Memorize—

$2\times8=16$	2 is one eighth of____.
$3\times8=24$	3 is one eighth of____.
$4\times8=32$	4 is one eighth of____.
$5\times8=40$	5 is one eighth of____.
$6\times8=48$	6 is one eighth of____.
$7\times8=56$	7 is one eighth of____.
$8\times8=64$	8 is one eighth of____.
$9\times8=72$	9 is one eighth of____.
$10\times8=80$	10 is one eighth of____.
$11\times8=88$	11 is one eighth of____.
$12\times8=96$	12 is one eighth of____.

3. One third of 24 and $\frac{1}{8}$ of 24 are how many?
4. One half of 24 and $\frac{1}{4}$ of 24 are how many?
5. One half of 32 and $\frac{1}{8}$ of 32 are how many?
6. One fourth of 32 and $\frac{1}{8}$ of 32 are how many?
7. One fifth of 40 and $\frac{1}{8}$ of 40 are how many?
8. One fourth of 40 and $\frac{1}{2}$ of 40 are how many?
9. One sixth of 48 and $\frac{1}{8}$ of 48 are how many?
10. One fourth of 48 and $\frac{1}{2}$ of 48 are how many?
11. One third of 48 and $\frac{1}{2}$ of 48 are how many?
12. One seventh of 56 and $\frac{1}{8}$ of 56 are how many?
13. One seventh of 56 and $\frac{1}{4}$ of 56 are how many?
14. One fourth of 56 and $\frac{1}{2}$ of 56 are how many?
15. One fourth of 64 and $\frac{1}{8}$ of 64 are how many?
16. One ninth of 72 and $\frac{1}{8}$ of 72 are how many?
17. One sixth of 72 and $\frac{1}{8}$ of 72 are how many?
18. One tenth of 80 and $\frac{1}{8}$ of 80 are how many?
19. One fifth of 80 and $\frac{1}{4}$ of 80 are how many?

1. Develop the multiplication table for 9.

2. Memorize —

$2\times9=18$	2 is one ninth of ___.
$3\times9=27$	3 is one ninth of ___.
$4\times9=36$	4 is one ninth of ___.
$5\times9=45$	5 is one ninth of ___.
$6\times9=54$	6 is one ninth of ___.
$7\times9=63$	7 is one ninth of ___.
$8\times9=72$	8 is one ninth of ___.
$9\times9=81$	9 is one ninth of ___.
$10\times9=90$	10 is one ninth of ___.
$11\times9=99$	11 is one ninth of ___.
$12\times9=108$	12 is one ninth of ___.

3. Count by 7's from 7 to 84, and back from 84 to 7.
4. Count by 8's from 8 to 96, and back from 96 to 8.
5. Count by 9's from 9 to 108, and back from 108 to 9.
6. Count by 9's from 8 to 107, and back from 107 to 8.
7. Count by 9's from 7 to 106, and back from 106 to 7.
8. Count by 9's from 6 to 105, and back from 105 to 6.
9. Count by 9's from 5 to 104, and back from 104 to 5.
10. Count by 9's from 4 to 103, and back from 103 to 4.
11. Count by 9's from 3 to 102, and back from 102 to 3.
12. Count by 9's from 2 to 101, and back from 101 to 2.
13. Count by 9's from 1 to 100, and back from 100 to 1.

14. One third of 18 and $\frac{1}{9}$ of 18 are how many?
15. One fourth of 36 and $\frac{1}{9}$ of 36 are how many?
16. One sixth of 36 and $\frac{1}{9}$ of 36 are how many?
17. One fifth of 45 and $\frac{1}{9}$ of 45 are how many?
18. One sixth of 54 and $\frac{1}{9}$ of 54 are how many?

State the sum at sight—

1.	8	8	8	8	8	8	8	8	8
	16	46	76	96	26	36	56	66	86
2.	8	8	8	8	8	8	8	8	8
	27	57	87	17	37	67	47	77	97
3.	8	8	8	8	9	9	9	9	9
	58	48	68	38	78	28	88	18	98
4.	7	7	7	7	6	6	6	6	6
	19	49	99	29	89	39	79	59	69

Add by stating the sums in order, beginning at the bottom of each column. Prove the work by adding the column, beginning at the top—

5.	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**
6	7	5	7	2	5	1	8	3	9
3	5	5	4	9	5	9	2	2	9
7	4	3	7	2	8	2	6	1	2
3	3	4	9	5	2	8	4	8	9
9	2	3	3	5	7	3	4	5	4
2	5	2	8	2	3	7	6	6	5
9	6	5	4	6	6	6	8	3	6
2	3	6	7	5	5	4	2	4	7
6	8	5	4	4	7	5	2	7	2
3	4	2	5	3	3	5	9	2	3
4	8	5	5	4	5	7	7	4	8
8	3	3	8	4	6	9	6	6	9
8	5	6	5	4	3	5	5	3	4
8	7	5	3	5	6	2	4	9	6

State the difference at sight—

1.	16	14	19	15	13	15	14
	7	9	2	9	4	8	8
2.	35	64	18	75	54	72	92
	9	6	4	6	5	8	8
3.	24	36	92	34	23	85	44
	8	5	6	7	6	7	9
4.	82	51	41	21	62	31	50
	7	4	5	3	9	2	6
5.	51	23	17	20	54	16	41
	8	4	5	3	6	7	4
6.	75	42	54	38	36	23	124
	9	8	7	3	6	7	9

Supply the missing number, which, subtracted from the upper, will leave the lower—

7.	56	47	92	91	78	29	68
	?	?	?	?	?	?	?
	48	39	86	83	72	23	59
8.	64	75	92	31	86	39	73
	?	?	?	?	?	?	?
	57	67	84	22	79	34	66
9.	64	67	21	82	98	44	41
	?	?	?	?	?	?	?
	59	58	14	75	91	35	35

State at sight the quotient and remainder—

1.	3)9	5)41	2)7	3)24	5)11	4)13
2.	2)10	5)32	2)14	4)32	5)36	4)24
3.	5)26	3)16	4)36	6)13	7)37	2)18
4.	5)45	2)13	7)30	6)9	4)7	8)41
5.	5)18	3)3	4)10	3)18	8)34	4)23
6.	6)24	2)5	3)22	2)16	4)28	2)9
7.	6)19	5)25	3)8	5)7	3)27	4)16
8.	9)45	6)38	8)57	5)24	9)66	7)29
9.	8)65	5)12	7)49	9)72	6)27	7)37
10.	8)32	5)29	6)32	7)22	8)48	4)14
11.	9)81	7)46	8)47	4)17	6)20	9)54
12.	8)56	9)31	9)46	9)83	10)95	9)11
13.	3)13	9)82	9)71	9)10	9)70	9)91
14.	8)83	8)53	7)41	8)80	9)16	10)21
15.	9)12	11)79	12)42	9)66	8)69	9)44
16.	9)20	11)14	12)67	10)92	9)17	11)50

State at sight the quotient and remainder —

1.	2)68	2)86	2)100	2)120	2)200	2)240
2.	3)24	3)30	3)39	3)69	3)90	3)120
3.	4)125	4)165	4)245	4)327	4)47	4)89
4.	5)60	5)65	5)110	5)120	5)115	5)125
5.	6)78	6)132	6)138	6)144	6)252	6)318
6.	7)147	7)224	7)294	7)364	7)371	7)423
7.	3)2100	3)1800	3)3000	3)3600	3)2106	
8.	4)2400	4)1608	4)3280	4)4460	4)4528	
9.	5)2000	5)2100	5)2110	5)2200	5)2220	
10.	6)2400	6)3000	6)2520	6)3240	6)4224	
11.	7)2100	7)2114	7)2240	7)2947	7)3717	
12.	8)1600	8)1616	8)2416	8)3360	8)4240	
13.	2)$100	2)$1.00	2)$.50	2)$1.50	2)$5.00	

14. What is $\frac{1}{6}$ of 12 inches? Of 24 hours? Of 36 feet?
15. What is $\frac{1}{7}$ of 14 bushels? Of 35 qt.? Of 42 wk.?
16. What is $\frac{1}{9}$ of $27? Of 36 inches? Of 54 rods?
17. What is $\frac{1}{8}$ of $16? Of 24 hours? Of 32 quarts?
18. What is $\frac{1}{3}$ of 456? Of 579? Of 768? Of 846?
19. What is $\frac{1}{4}$ of 468? Of 544? Of 572? Of 968?

1. Write the multiplication table for 10.
2. Write the multiplication table for 11.
3. Write the multiplication table for 12.
4. Draw a square foot. Divide it into square inches.
5. How many rows of 12 square inches?
6. One row is what part of the square?
7. Two rows make what part of the square?
8. Show two ways to mark off $\frac{1}{6}$ of the square.
9. Show two ways to mark off $\frac{1}{8}$ of the square.
10. Show three ways to mark off $\frac{1}{4}$ of the square.
11. Show three ways to mark off $\frac{1}{6}$ of the square.
12. One fifth of 20 and $\frac{1}{10}$ of 20 are how many?
13. One ninth of 90 and $\frac{1}{10}$ of 90 are how many?
14. One half of 22 and $\frac{1}{11}$ of 22 are how many?
15. One third of 33 and $\frac{1}{11}$ of 33 are how many?
16. One fourth of 48 and $\frac{1}{11}$ of 44 are how many?
17. One fifth of 55 and $\frac{1}{11}$ of 66 are how many?
18. One sixth of 66 and $\frac{1}{11}$ of 88 are how many?
19. One seventh of 49 and $\frac{1}{11}$ of 99 are how many?
20. One eighth of 56 and $\frac{1}{11}$ of 110 are how many?
21. One twelfth of 36 and $\frac{1}{9}$ of 36 are how many?
22. One twelfth of 48 and $\frac{1}{8}$ of 48 are how many?
23. One twelfth of 60 and $\frac{1}{7}$ of 63 are how many?
24. One twelfth of 72 and $\frac{1}{9}$ of 63 are how many?
25. One twelfth of 84 and $\frac{1}{8}$ of 72 are how many?
26. One twelfth of 96 and $\frac{1}{8}$ of 96 are how many?
27. One twelfth of 96 and $\frac{1}{6}$ of 96 are how many?
28. One twelfth of 96 and $\frac{1}{4}$ of 96 are how many?
29. One twelfth of 108 and $\frac{1}{7}$ of 84 are how many?
30. One twelfth of 108 and $\frac{1}{8}$ of 96 are how many?
31. One twelfth of 120 and $\frac{1}{10}$ of 120 are how many?
32. One twelfth of 132 and $\frac{1}{12}$ of 144 are how many?

Draw figure to show—

1. $\frac{1}{2}$ of $\frac{1}{3}$.
2. $\frac{1}{2}$ of $\frac{1}{2}$.
3. $\frac{1}{2}$ of $\frac{1}{4}$.
4. $\frac{1}{2}$ of $\frac{1}{5}$.
5. $\frac{1}{2}$ of $\frac{1}{6}$.
6. $\frac{1}{3}$ of $\frac{1}{2}$.
7. $\frac{1}{3}$ of $\frac{1}{4}$.
8. $\frac{1}{3}$ of $\frac{1}{3}$.
9. $\frac{1}{3}$ of $\frac{2}{3}$.
10. $\frac{1}{2}$ of $\frac{3}{5}$.
11. $\frac{1}{4}$ of $\frac{1}{2}$.
12. $\frac{1}{4}$ of $\frac{1}{3}$.
13. $\frac{1}{5}$ of $\frac{1}{2}$.
14. $\frac{1}{6}$ of $\frac{1}{2}$.
15. $\frac{1}{4}$ of $\frac{2}{3}$.

16. Four times $\frac{1}{5}$ of 15=____.
17. Five times $\frac{1}{6}$ of 18=____.
18. Six times $\frac{1}{7}$ of 21=____.
19. Seven times $\frac{1}{8}$ of 24=____.
20. Eight times $\frac{1}{9}$ of 27=____.
21. Nine times $\frac{1}{10}$ of 30=____.
22. Ten times $\frac{1}{11}$ of 44=____.
23. Eleven times $\frac{1}{12}$ of 36=____.
24. $\frac{1}{2}$ of 4 is $\frac{1}{3}$ of____.
25. $\frac{1}{2}$ of 4 is $\frac{1}{4}$ of____.
26. $\frac{1}{3}$ of 9 is $\frac{1}{4}$ of____.
27. $\frac{2}{3}$ of 9 is $\frac{1}{4}$ of____.
28. $\frac{1}{4}$ of 12 is $\frac{1}{5}$ of____.
29. $\frac{3}{4}$ of 12 is $\frac{1}{5}$ of____.
30. $\frac{1}{5}$ of 20 is $\frac{1}{6}$ of____.
31. $\frac{2}{5}$ of 20 is $\frac{1}{6}$ of_

32. $\frac{1}{7}$ of 14 is $\frac{1}{8}$ of____.
33. $\frac{3}{7}$ of 14 is $\frac{1}{7}$ of____.
34. $\frac{4}{7}$ of 21 is $\frac{1}{6}$ of____.
35. $\frac{1}{8}$ of 24 is $\frac{1}{9}$ of____.
36. $\frac{3}{8}$ of 24 is $\frac{1}{5}$ of____.
37. $\frac{1}{9}$ of 27 is $\frac{1}{2}$ of____.
38. $\frac{2}{9}$ of 27 is $\frac{1}{8}$ of____.
39. $\frac{1}{10}$ of 30 is $\frac{1}{6}$ of____.
40. $\frac{3}{10}$ of 30 is $\frac{1}{7}$ of____.
41. $\frac{1}{2}$ of 6 is $\frac{1}{4}$ of____.
42. $\frac{1}{4}$ of 16 is $\frac{1}{5}$ of____.
43. $\frac{1}{5}$ of 30 is $\frac{1}{7}$ of____.
44. $\frac{1}{7}$ of 42 is $\frac{1}{5}$ of____.
45. $\frac{1}{8}$ of 64 is $\frac{1}{7}$ of____.
46. $\frac{1}{9}$ of 81 is $\frac{1}{6}$ of____.
47. $\frac{1}{11}$ of 99 is $\frac{1}{7}$ of____.
48. $\frac{1}{12}$ of 96 is $\frac{1}{6}$ of____.
49. $\frac{1}{12}$ of 96 is $\frac{1}{9}$ of____.

50. $\frac{2}{3}$ of 9 is $\frac{3}{4}$ of____.
51. $\frac{3}{4}$ of 12 is $\frac{3}{5}$ of____.
52. $\frac{3}{5}$ of 25 is $\frac{3}{7}$ of____.
53. $\frac{3}{4}$ of 24 is $\frac{3}{7}$ of____.
54. $\frac{3}{7}$ of 49 is $\frac{3}{5}$ of____.
55. $\frac{5}{8}$ of 64 is $\frac{5}{9}$ of____.
56. 3×10 and $\frac{2}{5}$ of 10 are____.
57. $4\times$ 9 and $\frac{2}{3}$ of 9 are____.
58. 5×12 and $\frac{3}{4}$ of 12 are____.
59. 6×12 and $\frac{5}{6}$ of 12 are____.
60. $7\times$ 9 and $\frac{3}{4}$ of 12 are____.
61. 8×10 and $\frac{4}{5}$ of 10 are____.

1. Drill on factoring numbers less than 100—

4 is 2× 2.	25 is 5× 5.	55 is 5×11.
6 is 2× 3.	26 is 2×13.	56 is 7× 8.
8 is 2× 4.	27 is 3× 9.	60 is 5×12.
9 is 3× 3.	28 is 4× 7.	60 is 6×10.
10 is 2× 5.	30 is 3×10.	63 is 7× 9.
12 is 3× 4.	30 is 5× 6.	64 is 8× 8.
12 is 2× 6.	32 is 4× 8.	66 is 6×11.
14 is 2× 7.	33 is 3×11.	70 is 7×10.
15 is 3× 5.	35 is 5× 7.	72 is 6×12.
16 is 4× 4.	36 is 6× 6.	72 is 8× 9.
16 is 2× 8.	36 is 4× 9.	77 is 7×11.
18 is 2× 9.	36 is 3×12.	80 is 8×10.
18 is 3× 6.	40 is 4×10.	81 is 9× 9.
20 is 2×10.	40 is 5× 8.	84 is 7×12.
20 is 4× 5.	42 is 6× 7.	88 is 8×11.
21 is 3× 7.	44 is 4×11.	90 is 9×10.
22 is 2×11.	45 is 5× 9.	96 is 8×12.
24 is 2×12.	49 is 7× 7.	99 is 9×11.
24 is 3× 8.	50 is 5×10.	100 is 10×10.
24 is 4× 6.	54 is 6× 9.	144 is 12×12.

2. How many more is $\frac{2}{3}$ of 9 than $\frac{3}{4}$ of 8?
3. How many more is $\frac{2}{5}$ of 20 than $\frac{2}{5}$ of 15?
4. How many more is $\frac{2}{3}$ of 24 than $\frac{3}{5}$ of 20?
5. How many more is $\frac{3}{5}$ of 30 than $\frac{3}{7}$ of 28?
6. How many more is $\frac{3}{4}$ of 32 than $\frac{4}{7}$ of 35?
7. How many more is $\frac{5}{9}$ of 36 than $\frac{3}{10}$ of 40?
8. How many more is $\frac{3}{8}$ of 40 than $\frac{3}{7}$ of 42?
9. How many more is $\frac{7}{9}$ of 45 than $\frac{4}{7}$ of 49?
10. How many more is $\frac{6}{7}$ of 49 than $\frac{5}{7}$ of 56?
11. How many more is $\frac{5}{9}$ of 54 than $\frac{3}{7}$ of 63?

MULTIPLICATION TABLE.

1× 1= 1	2× 1= 2	3× 1= 3	4× 1= 4
1× 2= 2	2× 2= 4	3× 2= 6	4× 2= 8
1× 3= 3	2× 3= 6	3× 3= 9	4× 3=12
1× 4= 4	2× 4= 8	3× 4=12	4× 4=16
1× 5= 5	2× 5=10	3× 5=15	4× 5=20
1× 6= 6	2× 6=12	3× 6=18	4× 6=24
1× 7= 7	2× 7=14	3× 7=21	4× 7=28
1× 8= 8	2× 8=16	3× 8=24	4× 8=32
1× 9= 9	2× 9=18	2× 9=27	4× 9=36
1×10=10	2×10=20	3×10=30	4×10=40
1×11=11	2×11=22	3×11=33	4×11=44
1×12=12	2×12=24	3×12=36	4×12=48
5× 1= 5	6× 1= 6	7× 1= 7	8× 1= 8
5× 2=10	6× 2=12	7× 2=14	8× 2=16
5× 3=15	6× 3=18	7× 3=21	8× 3=24
5× 4=20	6× 4=24	7× 4=28	8× 4=32
5× 5=25	6× 5=30	7× 5=35	8× 5=40
5× 6=30	6× 6=36	7× 6=42	8× 6=48
5× 7=35	6× 7=42	7× 7=49	8× 7=56
5× 8=40	6× 8=48	7× 8=56	8× 8=64
5× 9=45	6× 9=54	7× 9=63	8× 9=72
5×10=50	6×10=60	7×10=70	8×10=80
5×11=55	6×11=66	7×11=77	8×11=88
5×12=60	6×12=72	7×12=84	8×12=96
9× 1= 9	10× 1= 10	11× 1= 11	12× 1= 12
9× 2= 18	10× 2= 20	11× 2= 22	12× 2= 24
9× 3= 27	10× 3= 30	11× 3= 33	12× 3= 36
9× 4= 36	10× 4= 40	11× 4= 44	12× 4= 48
9× 5= 45	10× 5= 50	11× 5= 55	12× 5= 60
9× 6= 54	10× 6= 60	11× 6= 66	12× 6= 72
9× 7= 63	10× 7= 70	11× 7= 77	12× 7= 84
9× 8= 72	10× 8= 80	11× 8= 88	12× 8= 96
9× 9= 81	10× 9= 90	11× 9= 99	12× 9=108
9×10= 90	10×10=100	11×10=110	12×10=120
9×11= 99	10×11=110	11×11=121	12×11=132
9×12=108	10×12=120	11×12=132	12×12=144

Copy and complete the table of equal parts—

1. $\frac{1}{2}$ of 2 is____.
2. $\frac{1}{3}$ of 3 is____.
3. $\frac{1}{2}$ of 4 is____.
4. $\frac{1}{4}$ of 4 is____.
5. $\frac{1}{5}$ of 5 is____.
6. $\frac{1}{2}$ of 6 is____.
7. $\frac{1}{3}$ of 6 is____.
8. $\frac{1}{6}$ of 6 is____.
9. $\frac{1}{7}$ of 7 is____.
10. $\frac{1}{2}$ of 8 is____.
11. $\frac{1}{4}$ of 8 is____.
12. $\frac{1}{8}$ of 8 is____.
13. $\frac{1}{3}$ of 9 is____.
14. $\frac{1}{9}$ of 9 is____.
15. $\frac{1}{2}$ of 10 is____.
16. $\frac{1}{5}$ of 10 is____.
17. $\frac{1}{2}$ of 12 is____.
18. $\frac{1}{3}$ of 12 is____.
19. $\frac{1}{4}$ of 12 is____.
20. $\frac{1}{6}$ of 12 is____.
21. $\frac{1}{2}$ of 14 is____.
22. $\frac{1}{7}$ of 14 is____.
23. $\frac{1}{3}$ of 15 is____.
24. $\frac{1}{5}$ of 15 is____.
25. $\frac{1}{2}$ of 16 is____.
26. $\frac{1}{4}$ of 16 is____.
27. $\frac{1}{8}$ of 16 is____.
28. $\frac{1}{2}$ of 18 is____.
29. $\frac{1}{3}$ of 18 is____.
30. $\frac{1}{6}$ of 18 is____.
31. $\frac{1}{9}$ of 18 is____.
32. $\frac{1}{2}$ of 20 is____.
33. $\frac{1}{4}$ of 20 is____.
34. $\frac{1}{5}$ of 20 is____.
35. $\frac{1}{10}$ of 20 is____.
36. $\frac{1}{3}$ of 21 is____.
37. $\frac{1}{7}$ of 21 is____.
38. $\frac{1}{2}$ of 24 is____.
39. $\frac{1}{3}$ of 24 is____.
40. $\frac{1}{4}$ of 24 is____.
41. $\frac{1}{6}$ of 24 is____.
42. $\frac{1}{8}$ of 24 is____.
43. $\frac{1}{5}$ of 25 is____.
44. $\frac{1}{3}$ of 27 is____.
45. $\frac{1}{9}$ of 27 is____.
46. $\frac{1}{4}$ of 28 is____.
47. $\frac{1}{7}$ of 28 is____.
48. $\frac{1}{2}$ of 30 is____.
49. $\frac{1}{3}$ of 30 is____.
50. $\frac{1}{5}$ of 30 is____.
51. $\frac{1}{6}$ of 30 is____.
52. $\frac{1}{10}$ of 30 is____.
53. $\frac{1}{2}$ of 32 is____.
54. $\frac{1}{4}$ of 32 is____.
55. $\frac{1}{8}$ of 32 is____.
56. $\frac{1}{5}$ of 35 is____.
57. $\frac{1}{7}$ of 35 is____.
58. $\frac{1}{2}$ of 36 is____.
59. $\frac{1}{3}$ of 36 is____.
60. $\frac{1}{4}$ of 36 is____.
61. $\frac{1}{6}$ of 36 is____.
62. $\frac{1}{9}$ of 36 is____.
63. $\frac{1}{2}$ of 40 is____.
64. $\frac{1}{4}$ of 40 is____.
65. $\frac{1}{5}$ of 40 is____.
66. $\frac{1}{8}$ of 40 is____.
67. $\frac{1}{2}$ of 42 is____.
68. $\frac{1}{3}$ of 42 is____.
69. $\frac{1}{6}$ of 42 is____.
70. $\frac{1}{7}$ of 42 is____.
71. $\frac{1}{3}$ of 45 is____.
72. $\frac{1}{5}$ of 45 is____.
73. $\frac{1}{9}$ of 45 is____.
74. $\frac{1}{2}$ of 48 is____.
75. $\frac{1}{3}$ of 48 is____.
76. $\frac{1}{4}$ of 48 is____.
77. $\frac{1}{6}$ of 48 is____.
78. $\frac{1}{8}$ of 48 is____.
79. $\frac{1}{7}$ of 49 is____.
80. $\frac{1}{6}$ of 54 is____.
81. $\frac{1}{9}$ of 54 is____.
82. $\frac{1}{7}$ of 56 is____.
83. $\frac{1}{8}$ of 56 is____.
84. $\frac{1}{7}$ of 63 is____.
85. $\frac{1}{9}$ of 63 is____.
86. $\frac{1}{4}$ of 64 is____.
87. $\frac{1}{8}$ of 64 is____.
88. $\frac{1}{4}$ of 72 is____.
89. $\frac{1}{6}$ of 72 is____.
90. $\frac{1}{8}$ of 64 is____.
91. $\frac{1}{8}$ of 72 is____.
92. $\frac{1}{9}$ of 72 is____.
93. $\frac{1}{9}$ of 81 is____.

In writing dollars and cents—

1. Place the sign ($) before the figure.
2. Place a point (.) between dollars and cents.
3. Place a cipher between the point and any number of cents less than 10.

1. 1 cent =___of a dollar.
2. 4 cents=___of a dollar.
3. 5 cents=___of a dollar.
4. 10 cents=___of a dollar.
5. 25 cents=___of a dollar.
6. 50 cents=___of a dollar.
7. 75 cents=___of a dollar.
8. $12\frac{1}{2}$ cents=___of a dollar.
9. $16\frac{2}{3}$ cents=___of a dollar.
10. $33\frac{1}{3}$ cents=___of a dollar.
11. $37\frac{1}{2}$ cents=___of a dollar.

12. $\$\frac{1}{2}$=___
13. $\$\frac{1}{3}$=___
14. $\$\frac{1}{4}$=___
15. $\$\frac{1}{5}$=___
16. $\$\frac{1}{6}$=___
17. $\$\frac{1}{8}$=___
18. $\$\frac{3}{8}$=___
19. $\$\frac{5}{8}$=___
20. $\$\frac{2}{3}$=___
21. $\$\frac{3}{4}$=___
22. $\$\frac{3}{5}$=___

23. Count by $12\frac{1}{2}$ from $12\frac{1}{2}$ to 100.
24. Count by $6\frac{1}{4}$ from $6\frac{1}{4}$ to 100.
25. Count by $16\frac{2}{3}$ from $16\frac{2}{3}$ to 100.
26. Count by $8\frac{1}{3}$ from $8\frac{1}{3}$ to 100.

How many articles—

27. At $.20 each can be bought for $2.40?
28. At $.25 each can be bought for $2.50?
29. At $.12$\frac{1}{2}$ each can be bought for $1.25?
30. At $.12$\frac{1}{2}$ each can be bought for $2.50?
31. At $.25 each can be bought for $5.50?
32. At $.16$\frac{2}{3}$ each can be bought for $2.00?
33. At $.16$\frac{2}{3}$ each can be bought for $3.00?
34. At $.33$\frac{1}{3}$ each can be bought for $2.00?

1. What per cent of a number is $\frac{1}{2}$ of it?
2. What per cent of a number is $\frac{1}{3}$ of it?
3. What per cent of a number is $\frac{1}{4}$ of it?
4. What per cent of a number is $\frac{1}{5}$ of it?
5. What per cent of a number is $\frac{1}{6}$ of it?
6. What per cent of a number is $\frac{1}{8}$ of it?
7. What per cent of a number is $\frac{2}{3}$ of it?
8. What per cent of a number is $\frac{3}{5}$ of it?
9. What per cent of a number is $\frac{3}{8}$ of it?
10. What per cent of a number is $\frac{3}{4}$ of it?
11. What per cent of a bushel is one peck?
12. What per cent of a bushel are three pecks?
13. What per cent of a peck is one quart?
14. What per cent of a peck are two quarts?
15. What per cent of a peck are three quarts?
16. What per cent of a peck are five quarts?
17. What per cent of a day are six hours?
18. What per cent of a day are eight hours?
19. What per cent of an hour are twenty minutes?
20. What per cent of an hour are thirty minutes?
21. What per cent of an hour are twelve minutes?
22. What per cent of a yard are nine inches?
23. What per cent of a yard are twelve inches?
24. What per cent of a yard are eighteen inches?
25. What per cent of a pound are four ounces?
26. What per cent of a pound are eight ounces?
27. What per cent of a pound are twelve ounces?
28. What per cent of a gallon is one quart?
29. What per cent of a quart is one pint?
30. What per cent of a quart is one gill?
31. What per cent of a quart are two gills?
32. What per cent of a yard is one half of a foot?

1. Count by $3\frac{1}{2}$ from $3\frac{1}{2}$ to 28, and back from 28 to $3\frac{1}{2}$.
2. Count by $3\frac{1}{3}$ from $3\frac{1}{3}$ to 30, and back from 30 to $3\frac{1}{3}$.
3. Count by $3\frac{1}{4}$ from $3\frac{1}{4}$ to 39, and back from 39 to $3\frac{1}{4}$.
4. Count by $3\frac{1}{5}$ from $3\frac{1}{5}$ to 32, and back from 32 to $3\frac{1}{5}$.
5. Count by $3\frac{2}{3}$ from $3\frac{2}{3}$ to 33, and back from 33 to $3\frac{2}{3}$.
6. Multiply $5\frac{1}{2}$ by 2 and by 3, and add the products.
7. Multiply $5\frac{1}{3}$ by 2 and by 3, and add the products.
8. Multiply $4\frac{1}{3}$ by 2 and by 3, and add the products.
9. Multiply $4\frac{1}{2}$ by 2 and by 3, and add the products.
10. Multiply $6\frac{1}{2}$ by 2 and by 3, and add the products.
11. Multiply $6\frac{1}{3}$ by 2 and by 3, and add the products.
12. Multiply $4\frac{2}{3}$ by 2 and by 3, and add the products.
13. Multiply $5\frac{2}{3}$ by 2 and by 3, and add the products.
14. Multiply $6\frac{2}{3}$ by 2 and by 3, and add the products.
15. Multiply 4 by $3\frac{1}{2}$ and by $4\frac{1}{2}$, and add the products.
16. Multiply 6 by $3\frac{1}{3}$ and by $4\frac{1}{3}$, and add the products.
17. Multiply 8 by $3\frac{1}{4}$ and by $4\frac{1}{4}$, and add the products.
18. Multiply 10 by $3\frac{1}{5}$ and by $4\frac{1}{5}$, and add the products.
19. Multiply 10 by $3\frac{1}{2}$ and by $3\frac{1}{5}$, and add the products.
20. Multiply 12 by $3\frac{1}{3}$ and by $3\frac{1}{4}$, and add the products.
21. Divide by 40: 81, 123, 167, 209, 243.
22. Divide by 42: 85, 129, 169, 211, 253.
23. Divide by 43: 89, 130, 175, 217, 230.
24. Divide by 49: 100, 150, 200, 250, 300.
25. Divide by 51: 105, 155, 210, 260, 361.

Make a problem requiring "change"—

26. By buying articles at the grocery.
27. By buying articles at the fruit-stand.
28. By buying articles at the dry-goods store.
29. By buying articles at the meat-market.
30. By buying articles at the clothing-store.

1. Draw a rectangle 3 inches by 4 inches. Draw another having the same area, 2 inches wide.

2. Draw a rectangle 4 inches by 6 inches. Draw another having the same area, 3 inches wide.

3. Draw a rectangle 12 inches by 8 inches. Draw another having the same area, 6 inches wide.

4. How many square inches in the surface of a 1-inch cube? Of a 2-inch cube? Of a 3-inch cube?

5. How many 1-inch cubes in a 2-inch cube? How many, if the 2-inch cube is doubled in length? How many, if it is doubled in length and in width?

6. A box is 4 inches by 4 inches by 6 inches. What is the surface of each end? Of each side? Of the top? Of the whole box?

7. How many 1-inch cubes will make a pile having the size and shape of the box?

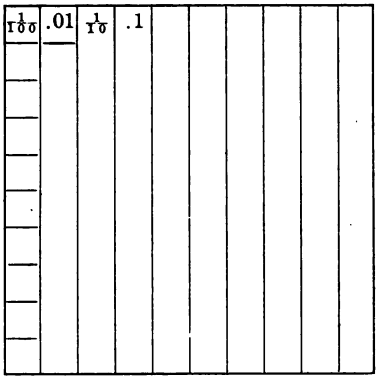
8. *Cord-wood* is 4 feet long. It is laid in piles 4 feet wide and 8 feet long. Such a pile is called a *cord*. How many square feet on each end of a cord? On each side? On the top? On the bottom?

9. How many 1-foot cubes in a cord? In 25% of a cord? In 50% of a cord?

10. How many cords of wood in a pile of 4-foot wood 8 feet high and 8 feet long? In a pile 4 feet high and 16 feet long? In a pile 4 feet high and 4 feet long? In a pile 4 feet high and 12 feet long? In a pile 4 feet high and 24 feet long? In a pile 8 feet high and 16 feet long?

11. A common brick is 2 inches by 4 inches by 8 inches. What is its surface? How many cubic inches in it?

12. Build with 1-inch cubes a solid $6\times4\times10$ inches. Give three ways to divide it into two equal parts. Give the surface of each half.



There are two ways to write one tenth: $\frac{1}{10}$ and .1.

There are two ways to write one hundredth: $\frac{1}{100}$ and .01.

When such fractions are written with a point (.) instead of with a denominator, they are called *decimals.*

The decimal method is used in writing numbers to represent money. Thus 5 cents are .05 of a dollar; 10 cents, .10 of a dollar; two dollars and twenty-five cents are written $2.25.

1. Read .1; .6; .9; .45; 11.4; 13.47; 51.67; 6.15; 8.24.
2. Read 100.73; 27.02; 50.57; 6.67; 41.01; 120.03.
3. Read .4; .8; .1; 7.3; 10.9; 392.6; 7198.2.
4. Write five tenths; one tenth; nine tenths.
5. Write 17 and 3 tenths; 28 and 6 tenths.
6. Write 240 and 9 tenths; 1006 and 5 tenths.
7. Write two tenths; five hundred sixty and four tenths.
8. Read .43; .91; .04; 8.32; 5.09; 47.47; 5080.06.
9. Write 3 hundredths; 51 hundredths.
10. Write 15 and 15 hundredths; 328 and 11 hundredths.
11. Write 30 and 30 hundredths; 200 and 2 hundredths.

1. At 4 cents a lb., how many ounces will 1 cent buy?
2. At 4 cents a lb., how many ounces will 5 cents buy?
3. At 4 cents a lb., how many ounces will 9 cents buy?
4. At 4 cents a lb., how many ounces will 11 cents buy?
5. At 4 cents a lb., how many ounces will 65 cents buy?
6. At $5 a barrel, how much will $1 buy?
7. At $5 a barrel, how much will $3 buy?
8. At $5 a barrel, how many barrels will $10 buy?
9. At $5 a barrel, how many barrels will $11 buy?
10. At $5 a barrel, how many barrels will $12 buy?
11. At $5 a barrel, how many barrels will $15 buy?
12. At $5 a barrel, how many barrels will $16 buy?
13. At $5 a barrel, how many barrels will $18 buy?
14. At $5 a barrel, how many barrels will $24 buy?
15. At $5 a barrel, how many barrels will $27 buy?
16. At $5 a barrel, how many barrels will $39 buy?
17. At $5 a barrel, how many barrels will $96 buy?
18. At $6 a barrel, how much can be bought for $1?
19. At $6 a barrel, how much can be bought for $7?
20. At $6 a barrel, how much can be bought for $9?
21. At $6 a barrel, how much can be bought for $15?
22. At $6 a barrel, how much can be bought for $17?
23. At $6 a barrel, how much can be bought for $27?
24. At $6 a barrel, how much can be bought for $35?
25. At $6 a barrel, what is the value of $\frac{1}{6}$ of a barrel?
26. At $6 a barrel, what is the value of $\frac{2}{6}$ of a barrel?
27. At $6 a barrel, what is the value of $\frac{4}{6}$ of a barrel?
28. At $6 a barrel, what is the value of $\frac{5}{6}$ of a barrel?
29. At 8 cents a pound, how much sugar is worth 1 cent?
30. At 8 cents a pound, how much sugar is worth 5 cents?
31. At 8 cents a pound, how much sugar is worth 9 cents?
32. At 8 cents a pound, how much sugar is worth 15 cents?

1. What is $\frac{1}{9}$ of 9? $\frac{2}{9}$ of 9? $\frac{3}{9}$ of 9?
2. 9 times 9 and $\frac{1}{9}$ of 9 are how many?
3. 8 times 9 and $\frac{2}{9}$ of 9 are how many?
4. 18 times 9 and $\frac{5}{9}$ of 9 are how many?
5. 37 times 9 and $\frac{6}{9}$ of 9 are how many?
6. 25 times 9 and $\frac{7}{9}$ of 9 are how many?
7. 27 times 9 and $\frac{8}{9}$ of 9 are how many?
8. 99 times 9 and $\frac{8}{9}$ of 9 are how many?
9. 67 times 9 and $\frac{4}{9}$ of 9 are how many?
10. 67 times 9 and $\frac{2}{3}$ of 9 are how many?
11. 3 times 5 and $\frac{3}{5}$ of 5 are how many times 3?
12. 4 times 5 and $\frac{4}{5}$ of 5 are how many times 4?
13. 8 times 5 and $\frac{2}{5}$ of 5 are how many times 8?
14. 6 times 9 and $\frac{6}{9}$ of 9 are how many times 10?
15. 6 times 9 and $\frac{6}{9}$ of 9 are how many times 12?
16. 6 times 9 and $\frac{6}{9}$ of 9 are how many times 15?
17. 19 times 6 and $\frac{1}{3}$ of 6 are how many times 42?
18. 19 times 6 and $\frac{2}{3}$ of 6 are how many times 2?
19. 19 times 6 and $\frac{5}{6}$ of 6 are how many times 17?
20. 17 times 6 and $\frac{1}{3}$ of 6 are how many times 19?
21. 29 times 7 and $\frac{4}{7}$ of 7 are how many times 9?
22. 29 times 7 and $\frac{5}{7}$ of 7 are how many times 16?
23. 15 times 7 and $\frac{3}{7}$ of 7 are how many times 12?
24. 38 times 7 and $\frac{4}{7}$ of 7 are how many times 27?
25. 19 times 4 and $\frac{2}{4}$ of 4 are how many times 26?
26. 19 times 4 and $\frac{1}{4}$ of 4 are how many times 11?
27. 7 times 18 and $\frac{7}{9}$ of 18 are how many times 14?
28. 9 times 15 and $\frac{3}{5}$ of 15 are how many times 24?
29. 6 times 27 and $\frac{7}{9}$ of 27 are how many times 61?
30. 75 times 35 and $\frac{5}{7}$ of 35 are how many times 50?
31. 27 times 27 and $\frac{2}{3}$ of 27 are how many times 83?
32. 27 times 36 and $\frac{7}{9}$ of 36 are how many times 25?

1. John had 4 cents, his father gave him 6 more, and each of his two brothers gave him 5 cents. He then bought 6 apples at the rate of 2 for 5 cents. How many cents had he left?

2. A man had $25. After buying a barrel of flour for $7.50, sugar for $2.25, and 8 pounds of coffee at 37½ cents a pound, how much money had he remaining?

3. A man traveled east from A to B, 16 miles; from B to C, 12 miles; from C to D, 8 miles; and back to C. How far did he travel? How far from his starting-point did he stop?

4. Albert bought 20 peaches for 45 cents. He sold 12 of them for 2 cents each, and the rest for 3 cents each. What was his gain or loss?

5. Three boys — Edwin, Henry, and Willie — went to the orchard for apples. Edwin got 3, Henry got 5, and Willie got 10. Their father asked them to divide the apples equally among them. How was it done?

6. A man went out to collect some of his bills and to make some purchases. He collected $50 from A, and $35.75 from B. He then bought a barrel of flour for $7.50, a quarter of beef for $6.25, and 50 pounds of sugar at 6½ cents a pound. How much of his money remained?

7. A boy had in his purse $5. He took at one time $1.50, at another time $.40, and at another time $1.10. How much was left?

8. If a boy buys apples for 1 cent each, and sells them at the rate of 2 for 3 cents, what will he make if he buys 10 cents' worth?

9. If 3 men earn $108 in 9 days, what does 1 man earn in 1 day?

10. If 6 men earn $84 in 7 days, what is the wages of 1 man for 1 day's work?

1. Memorize—

12 inches make 1 foot.
3 feet make 1 yard.
5½ yards make 1 rod.
16½ feet make 1 rod.

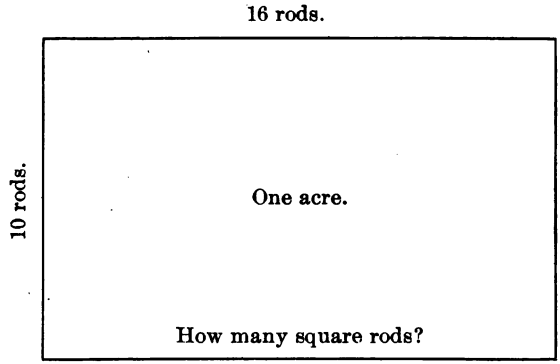
2. How many feet in 2 yards? In 2½ yards?
3. How many yards in 2 rods? In 3 rods?
4. Count by 5½ from 5½ to 55, and back from 55 to 5½.
5. How many feet in 2 rods? In 3 rods? In ½ rod?
6. How many inches in 1 rod? In 2 rods? In ½ rod?
7. How many inches in 5 yd.? In ½ yd.? In 5½ yd.?

Find the other dimension of—

8. A floor 20 feet on one side, and containing 200 sq. ft.
9. A floor 25 feet on one side, and containing 200 sq. ft.
10. A floor 40 feet on one side, and containing 200 sq. ft.
11. A floor 20 feet on one side, and containing 400 sq. ft.
12. A floor 25 feet on one side, and containing 400 sq. ft.
13. A floor 40 feet on one side, and containing 400 sq. st.
14. A floor 50 feet on one side, and containing 400 sq. ft.

In a room 15 feet wide, 21 feet long, and 9 feet high—

15. Find the square feet on each side wall.
16. Find the square feet on each end wall.
17. Find the square feet on the ceiling.
18. Find the square yards on the four walls.
19. Find the square yards on the ceiling.
20. Find the cost of papering the ceiling at $.25 a sq. yd.
21. Find the cost of carpeting the floor at $2.00 a sq. yd.
22. Find the cost of plastering both the walls and ceiling at $.30 a square yard.



1. What is 10% of an acre? 25%? 12½%? 50%?
2. What are the dimensions of a half-acre?
3. An acre lot 20 rods long is how many rods wide?
4. An acre lot 32 rods long is how many rods wide?
5. An acre lot 30 rods long is how many rods wide?
6. How many square rods in ½ acre? ¼? ⅕? ⅛? $\frac{1}{10}$?
7. How many rods in a lot 8 rods wide and 10 rods long?
8. How many rods in a lot 8 rods wide and 20 rods long?
9. How many rods in a lot 8 rods wide and 30 rods long?
10. How many rods in a lot 8 rods wide and 40 rods long?
11. How many rods in a lot 10 rods wide and 32 rods long?
12. How many rods in a lot 10 rods wide and 24 rods long?
13. How many rods in a lot 10 rods wide and 48 rods long?
14. How many rods in a lot 10 rods wide and 40 rods long?
15. How many rods in a lot 16 rods wide and 10 rods long?
16. How many rods in a lot 16 rods wide and 20 rods long?
17. How many rods in a lot 16 rods wide and 30 rods long?
18. How many rods in a lot 16 rods wide and 40 rods long?
19. How many rods in a lot 16 rods wide and 80 rods long?
20. How many rods in a lot 20 rods wide and 32 rods long?
21. How many rods in a lot 20 rods wide and 40 rods long?

1. Memorize —

100 pounds make 1 cental.
2000 pounds make 1 ton.

2. How many pounds of grain in $\frac{1}{2}$ of a ton?
3. How many pounds of grain in $\frac{3}{4}$ of a ton?
4. How many centals of wheat in $\frac{1}{5}$ of a ton?
5. How many centals of wheat in $\frac{1}{20}$ of a ton?
6. How many centals of wheat in $1\frac{3}{4}$ tons?
7. Find the cost of 5 centals of grain at \$12 a ton.
8. Find the cost of 10 centals of grain at \$16 a ton.
9. Find the cost of 1000 pounds of grain at \$.60 a cental.
10. Find the cost of $\frac{2}{5}$ of a ton of grain at \$.75 a cental.
11. What part of a ton are 200 pounds? 250 pounds?
12. What part of a ton are 500 pounds? 400 pounds?
13. What part of a ton are 1200 pounds? 1600 pounds?
14. What part of a ton are 1250 pounds? 1750 pounds?
15. At \$6 a ton, find the cost of 100 pounds.
16. At \$6 a ton, find the cost of 2100 pounds.
17. At \$6 a ton, find the cost of 2500 pounds.
18. At \$6 a ton, find the cost of 2250 pounds.
19. At \$4 a ton, how many pounds will cost \$.50?

SUGGESTION. — \$1.00 will buy ——; \$.50 will buy ——.

20. At \$4 a ton, how many pounds will cost \$.20?
21. At \$4 a ton, how many pounds will cost \$.25?
22. At \$4 a ton, how many pounds will cost \$.30?
23. Find the cost of 100 pounds at the rate of \$2.00 a ton.

SUGGESTION. — 1000 pounds cost ——; 100 pounds cost ——.

24. Find the cost of 100 pounds at the rate of \$3.00 a ton.
25. Find the cost of 200 pounds at the rate of \$5.00 a ton.
26. Find the cost of 300 pounds at the rate of \$2.50 a ton.
27. Find the cost of 400 pounds at the rate of \$9.00 a ton.

1. What part of a foot is 3 times .2 of a foot?
2. What part of a foot is 5 times .2 of a foot?
3. What is 4 times .5 of a foot? $5 \times .6$ of a foot?
4. What is 6 times .01? 6 times .02? 6 times .03?
5. What is $7 \times .4$? $7 \times .5$? $7 \times .7$? $7 \times .9$?
6. What is $12 \times .1$? $12 \times .2$? $12 \times .5$? $12 \times .8$?
7. What is $12 \times .01$? $12 \times .05$? $9 \times .08$?
8. What is $1 \times .1$? $10 \times .1$? $.1 \times .1$?
9. What is $.2 \times .2$? $.3 \times .3$? $.4 \times .4$?
10. What is $.1 \times .01$? $.01 \times .01$? $.02 \times .02$?
11. What is $.4 \times .9$? $.4 \times .09$? $.04 \times .09$?
12. How many tenths in 2.5? In 1.6? In 2.9?
13. How many times .5 in 1.5? In 2.5? In 3.5?
14. At \$5 a ton, find the cost of .2 of a ton of coal.
15. At \$5 a ton, find the cost of .02 of a ton of coal.
16. If a ton of hay costs \$20, what will .5 of a ton cost?
17. If an article costs \$.20, what will .5 of it cost?
18. How many times .3 of a dollar in .9 of a dollar?
19. How many times .2 of a dollar in .8 of a dollar?
20. How many times .5 in 10 tenths? In 20 tenths?
21. How many times .3 in 12 tenths? In 15 tenths?
22. How many times .7 in 2.1? In 4.9?
23. How many times 8 in 5.6? 7 in 5.6?
24. How many times .05 in .45? .5 in .45?
25. How many times .08 in .72? .9 in .72?
26. If a ton costs \$5.6, what will 5 tons cost?
27. If a ton costs \$5.6, what will .5 of a ton cost?
28. If a hat costs \$2.2, what will 3 hats cost?
29. At .5 of a dollar each, how many books will \$5 buy?
30. At .5 of a dollar each, how many books will \$15 buy?
31. Nine dollars were divided among some boys, and each boy received .3 of a dollar. How many boys were there?

1.

30.00+ 9.02+ 5.760+ .28 equals____.
25.00+50.00+ 9.125 equals____.
32.04+ 5.67+95.250+ 7.84 equals____.
5.84+ 3.57+ 4.920+65.00 equals____.
____ + ____ + ____ + ____ equals____.

2.

8.270+ 4.328+59.25+ .06 equals____.
23.850+29.470+86.32+89.45 equals____.
81.320+64.390+54.72+38.43 equals____.
24.375+88.840+37.25+17.94 equals____.
____ + ____ + ____ + ____ equals____.

3.

14.57+93.29+ 6.25+ 4.375+19.25 equals____.
39.06+48.27+33.29+74.080+ 9.50 equals____.
____ + ____ + ____ + ____ + ____ equals____.

4.

12.42+ 7.93+ 5.34+16.22+37.18 equals____.
40.87+78.19+28.99+92.42+70.36 equals____.
____ + ____ + ____ + ____ + ____ equals____.

5.

28.56+91.23+45.67+91.35+79.24 equals____.
68.98+76.54+41.28+20.16+70.95 equals____.
____ + ____ + ____ + ____ + ____ equals____.

6.

69.09+26.34+20.93+32.15+81.93+129.09 equals____.
25.86+39.06+ 8.27+30.33+74.08+ 9.51 equals____.
____ + ____ + ____ + ____ + ____ + ____ equals____.

1. Memorize—

$\frac{1}{2}=.50=50\%$
$\frac{1}{3}=.33\frac{1}{3}=33\frac{1}{3}\%$
$\frac{1}{4}=.25=25\%$
$\frac{3}{4}=.75=75\%$
$\frac{1}{5}=.20=20\%$

2. 15 is what per cent of 60? Of 45? Of 150?
3. \$5 is what per cent of \$20? Of \$25? Of \$15?
4. \$20 is 50% of what sum? 25%? 10%? $33\frac{1}{3}\%$?
5. \$15 is 25% of what sum? 20%? 10%? $33\frac{1}{3}\%$?
6. \$50 is what per cent of 100? Of 150? Of 200?
7. \$40 is what per cent of 120? Of 160? Of 200?
8. 75% of 12 is 50% of what number?
9. 25% of 240 is 10% of what number?
10. 1 foot is what per cent of 1 yard?
11. 9 inches are what per cent of 1 yard?
12. Write 10% of a yard in inches, in decimal form.
13. Write 10% of a foot in inches, in decimal form.
14. Write 10% of a yard in feet, in decimal form.
15. Write 10% of a quart in pints, in decimal form.
16. Write 10% of a peck in pints, in decimal form.
17. Write 10% of a peck in quarts, in decimal form.
18. Write 10% of a bushel in pecks, in decimal form.
19. Write 10% of a bushel in quarts, in decimal form.
20. Write 10% of a bushel in pints, in decimal form.
21. $33\frac{1}{3}\%$ of 300 yards is 20% of how many yards?
22. 20% of 40 yards is 50% of how many yards?
23. 50% of 100 yards is 25% of how many yards?
24. 75% of 60 yards is what per cent of 90 yards?
25. $33\frac{1}{3}\%$ of 75 yards is what per cent of 100 yards?
26. $33\frac{1}{3}\%$ of 60 yards is what per cent of 100 yards?

1. Benjamin Franklin was born in the year 1706. He died when he was 84 years of age. In what year did he die?

2. Washington died in 1799, at the age of 67 years. In what year was he born?

3. Two merchants went into business together. One put $5600 into the business; the other put in $1000 more than the first. What was the whole amount of their capital?

4. Three merchants went into business together. The first put in $5000, the second put in $1600 more than the first, and the third put in $2000 less than the second. What was the whole amount of their capital?

5. The smaller of two numbers is 4520, and their difference is 540. What is the greater? What is their sum?

6. One farm was sold for $5820, and another for $376 less. What did both together bring?

7. A lady went shopping, and took $25 in her purse. She paid $6 for a bonnet, $3.50 for a pair of shoes, $2.65 at the market, and $5.65 for sheeting. How much money had she left?

8. One house was sold for $6254, another was sold for $1746 less than the first. What did both houses bring?

9. A farmer went to the village with $150. After paying the blacksmith $23.50, the grocer $73.90, and the clothier $43.75, how much had he left?

10. A farm, with the cattle, sheep, horses, and hogs, was worth $8000. The cattle were worth $240, the sheep $175, the horses $540, and the hogs $135. What was the value of the land? The cattle and horses were worth how much more than the sheep and hogs?

11. A clerk was sent to collect $25, $140, $256, $69, and $3.25. What was the total sum to be returned to his employer?

1. Count by $1\frac{1}{2}$ from $1\frac{1}{2}$ to 15, and back from 15 to $1\frac{1}{2}$.
2. Count by $1\frac{1}{3}$ from $1\frac{1}{3}$ to 16, and back from 16 to $1\frac{1}{3}$.
3. Count by $1\frac{1}{4}$ from $1\frac{1}{4}$ to 15, and back from 15 to $1\frac{1}{4}$.
4. Count by $1\frac{1}{5}$ from $1\frac{1}{5}$ to 12, and back from 12 to $1\frac{1}{5}$.
5. Count by $1\frac{1}{6}$ from $1\frac{1}{6}$ to 14, and back from 14 to $1\frac{1}{6}$.
6. Count by $2\frac{1}{2}$ from $2\frac{1}{2}$ to 15, and back from 15 to $2\frac{1}{2}$.
7. Count by $2\frac{1}{3}$ from $2\frac{1}{3}$ to 14, and back from 14 to $2\frac{1}{3}$.
8. Count by $2\frac{1}{4}$ from $2\frac{1}{4}$ to 18, and back from 18 to $2\frac{1}{4}$.
9. Count by $2\frac{1}{5}$ from $2\frac{1}{5}$ to 11, and back from 11 to $2\frac{1}{5}$.
10. Count by $2\frac{1}{6}$ from $2\frac{1}{6}$ to 13, and back from 13 to $2\frac{1}{6}$.
11. Count by $2\frac{1}{7}$ from $2\frac{1}{7}$ to 15, and back from 15 to $2\frac{1}{7}$.
12. Count by $2\frac{1}{8}$ from $2\frac{1}{8}$ to 17, and back from 17 to $2\frac{1}{8}$.
13. Count by $2\frac{1}{9}$ from $2\frac{1}{9}$ to 19, and back from 19 to $2\frac{1}{9}$.
14. Count by $3\frac{1}{8}$ from $3\frac{1}{8}$ to 20, and back from 20 to $3\frac{1}{8}$.
15. Count by $3\frac{1}{4}$ from $3\frac{1}{4}$ to 13, and back from 13 to $3\frac{1}{4}$.
16. Count by $3\frac{1}{5}$ from $3\frac{1}{5}$ to 16, and back from 16 to $3\frac{1}{5}$.
17. Count by $3\frac{1}{6}$ from $3\frac{1}{6}$ to 19, and back from 19 to $3\frac{1}{6}$.
18. Count by $3\frac{1}{7}$ from $3\frac{1}{7}$ to 22, and back from 22 to $3\frac{1}{7}$.
19. Count by $3\frac{1}{8}$ from $3\frac{1}{8}$ to 25, and back from 25 to $3\frac{1}{8}$.
20. Count by $3\frac{1}{9}$ from $3\frac{1}{9}$ to 28, and back from 28 to $3\frac{1}{9}$.
21. Count by $4\frac{1}{2}$ from $4\frac{1}{2}$ to 18, and back from 18 to $4\frac{1}{2}$.
22. Count by $4\frac{1}{3}$ from $4\frac{1}{3}$ to 26, and back from 26 to $4\frac{1}{3}$.
23. Count by $4\frac{1}{4}$ from $4\frac{1}{4}$ to 34, and back from 34 to $4\frac{1}{4}$.
24. Count by $4\frac{1}{5}$ from $4\frac{1}{5}$ to 21, and back from 21 to $4\frac{1}{5}$.
25. Count by $4\frac{1}{6}$ from $4\frac{1}{6}$ to 25, and back from 25 to $4\frac{1}{6}$.
26. Count by $4\frac{1}{7}$ from $4\frac{1}{7}$ to 29, and back from 29 to $4\frac{1}{7}$.
27. Count by $4\frac{1}{8}$ from $4\frac{1}{8}$ to 33, and back from 33 to $4\frac{1}{8}$.
28. Count by $5\frac{1}{2}$ from $5\frac{1}{2}$ to 33, and back from 33 to $5\frac{1}{2}$.
29. Count by $5\frac{1}{3}$ from $5\frac{1}{3}$ to 32, and back from 32 to $5\frac{1}{3}$.
30. Count by $5\frac{1}{4}$ from $5\frac{1}{4}$ to 21, and back from 21 to $5\frac{1}{4}$.
31. Count by $5\frac{1}{5}$ from $5\frac{1}{5}$ to 26, and back from 26 to $5\frac{1}{5}$.
32. Count by $5\frac{1}{6}$ from $5\frac{1}{6}$ to 31, and back from 31 to $5\frac{1}{6}$.

Add—

1.	2.	3.	4.	5.	6.	7.	8.
$12\frac{1}{2}$	$10\frac{1}{2}$	$15\frac{1}{2}$	$25\frac{1}{2}$	$16\frac{2}{3}$	$45\frac{2}{3}$	$37\frac{3}{4}$	$75\frac{2}{3}$
$8\frac{1}{2}$	$20\frac{1}{2}$	$41\frac{1}{4}$	$32\frac{3}{4}$	$24\frac{1}{2}$	$45\frac{1}{2}$	$62\frac{1}{2}$	$24\frac{1}{4}$

9.	10.	11.	12.	13.	14.	15.
$123\frac{1}{6}$	$234\frac{5}{6}$	$456\frac{3}{5}$	$633\frac{3}{4}$	$842\frac{2}{3}$	$939\frac{2}{5}$	$567\frac{2}{3}$
$567\frac{1}{3}$	$456\frac{1}{6}$	$134\frac{3}{5}$	$234\frac{3}{4}$	$49\frac{3}{5}$	$15\frac{4}{5}$	$123\frac{2}{6}$

Subtract—

16.	17.	18.	19.	20.	21.	22.
$35\frac{1}{2}$	$75\frac{1}{3}$	$75\frac{1}{4}$	$75\frac{1}{5}$	$100\frac{3}{4}$	$100\frac{2}{3}$	$100\frac{3}{5}$
$25\frac{1}{4}$	$25\frac{1}{6}$	$25\frac{1}{8}$	$25\frac{1}{10}$	$75\frac{1}{2}$	$75\frac{1}{3}$	$75\frac{1}{2}$

23.	24.	25.	26.	27.	28.	29.
$100\frac{1}{2}$	$100\frac{1}{3}$	$100\frac{1}{4}$	$100\frac{1}{4}$	$100\frac{2}{3}$	$100\frac{3}{5}$	$100\frac{3}{8}$
$25\frac{1}{6}$	$35\frac{1}{6}$	$45\frac{1}{6}$	$5\frac{1}{6}$	$10\frac{1}{6}$	$15\frac{1}{6}$	$50\frac{1}{6}$

Multiply—

30.	31.	32.	33.	34.	35.	36.
$134\frac{1}{2}$	$345\frac{1}{3}$	$456\frac{1}{4}$	$567\frac{1}{5}$	$678\frac{2}{3}$	$333\frac{1}{3}$	$666\frac{1}{4}$
2	3	4	5	3	4	2

37.	38.	39.	40.	41.	42.	43.
45.6	67.5	17.50	8.4	15.50	16.8	9.25
4	5	3	12	25	50	16

Divide—

44.	45.	46.	47.	48.	49.
2)1.2	3)1.5	4)2.4	5)2.5	6)3.0	7)4.2

Make change from a $10 bill for—

1. 12 yards of ribbon at 5 cents a yard.
2. 3 dozen pencils at 25 cents a dozen.
3. 1 week's board at $1.25 a day.
4. 4 gallons of milk at 5 cents a pint.
5. 12 bushels of apples at 10 cents a peck.
6. 5½ gallons of oil at 20 cents a gallon.

Find the cost of—

7. 70,000 pounds of tea at 35 cents a pound.
8. 35 quarts of berries at 25 cents a quart.
9. 2,400 pencils at 25 cents a dozen.
10. 2,500 yards of ribbon at 9 cents a yard.
11. 400 pairs of boots at $4.50 a pair.
12. 1,200 bushels of wheat at 40 cents a bushel.

13. What will it cost to build a railroad 275 miles long, at $25,500 a mile?

14. What is the annual salary paid to an army of 60,000 men, at $156 a man?

15. If your pulse beats 65 times a minute, how many times does it beat in an hour? How many times in 24 hours? How many times in a week? How many times during the present month?

16. If 16 men can do a piece of work in 16 days, how long will it take one man to do it?

17. If 25 men can do a piece of work in 25 days, how long will it require one man to do it?

18. Two men set out from the same place, at the same time, and in opposite directions. One traveled at the rate of 42 miles a day, the other at the rate of 36 miles a day. How far apart were they at the end of 5 days?

1. Memorize—

12	inches	make 1 foot.
3	feet	make 1 yard.
$5\frac{1}{2}$	yards	make 1 rod.
320	rods	make 1 mile.

2. How many rods in 50% of a mile?
3. How many rods in 25% of a mile?
4. How many rods in $12\frac{1}{2}$% of a mile?
5. How many rods in 10% of a mile?
6. How many rods in $\frac{1}{2}$ and $\frac{1}{4}$ of a mile?
7. How many rods in $\frac{1}{2}$ and $\frac{1}{8}$ of a mile?
8. How many rods in $\frac{1}{2}$ and $\frac{1}{10}$ of a mile?
9. How many rods in $\frac{1}{4}$ and $\frac{1}{8}$ of a mile?
10. How many rods in $\frac{1}{8}$ and $\frac{1}{10}$ of a mile?
11. How many rods in $\frac{1}{2}$ less $\frac{1}{4}$ of a mile?
12. How many rods in $\frac{1}{2}$ less $\frac{1}{4}$ of a mile?
13. How many rods in $\frac{1}{2}$ less $\frac{1}{10}$ of a mile?
14. How many rods in $\frac{1}{4}$ less $\frac{1}{8}$ of a mile?
15. How many rods in $\frac{1}{4}$ less $\frac{1}{10}$ of a mile?
16. How many rods in $\frac{1}{8}$ less $\frac{1}{10}$ of a mile?
17. How many rods in 50% of $\frac{1}{2}$ of a mile?
18. How many rods in 50% of $\frac{1}{4}$ of a mile?
19. How many rods in 50% of $\frac{1}{8}$ of a mile?
20. How many rods in 50% of $\frac{1}{10}$ of a mile?
21. How many rods in 25% of $\frac{1}{2}$ of a mile?
22. How many rods in 25% of $\frac{1}{4}$ of a mile?
23. How many rods in 25% of $\frac{1}{8}$ of a mile?
24. How many rods in $12\frac{1}{2}$% of $\frac{1}{2}$ of a mile?
25. How many rods in 25% of $\frac{1}{10}$ of a mile?
26. How many rods in $12\frac{1}{2}$% of $\frac{1}{4}$ of a mile?
27. How many rods in $12\frac{1}{2}$% of $\frac{1}{8}$ of a mile?

1. If 3 cords of wood cost $12, what will 1 cord cost?
2. If 3 cords of wood cost $12, what will ½ cord cost?
3. If 3 cords of wood cost $12, what will 8 cords cost?
4. If 5 hats cost $8, what will 15 hats cost?
5. If 30 hats cost $35, what will 6 hats cost?
6. If 6 chairs cost $10, what will 18 chairs cost?
7. If 8 tables cost $72, what will 9 tables cost?
8. At $.45 a lb., what is the cost of 2⅓ lb. of tea?
9. At $.60 a lb., what is the cost of 8 oz. of tea?
10. At $.60 a lb., what is the cost of 24 oz. of tea?
11. At $.10 an hour, what does a boy earn in 5½ hours?
12. At $.10 a peck, what is the cost of 2½ bu. of potatoes?
13. At $8 a ton, what is the cost of 3000 lb. of coal?
14. At $3 per 500 lb., what are 6 tons of hay worth?
15. At $.10 a qt., what are 2 pk. of berries worth?
16. At $.12 a qt., what is the cost of 1½ pk. of nuts?
17. At $.12 a ft., what is the cost of 3½ yd. of matting?
18. At $.24 a pk., what is the cost of 7 qt. of beans?
19. At $.10 a pk., what is the cost of 2½ bu. of oats?
20. At $.08 a qt., what is the cost of 1½ pk. of beans?
21. At $1 a cental, what is the cost of 1½ tons of wheat?
22. What is the cost of 6 lb. of rice, if ⅓ lb. cost 3 cents?
23. What is the cost of 3 oranges, if 15 cost $.35?
24. What is the cost of 28 tops, if 7 tops cost $.10?
25. What is the cost of 18 hats, if 36 hats cost $40?
26. What is the cost of 7 hats, if 28 hats cost $16?
27. What is the cost of 16 books, if 4 books cost $5?
28. What is the cost of 16 books, if 48 books cost $50?
29. What is the cost of 24 pears, if 6 pears cost $.10?
30. What is the cost of 4 tons of coal, if ¼ ton cost $2?
31. What is the cost of 4 chairs, if 12 chairs cost $108?
32. What is the cost of 12 hats, if 4 hats cost $5?

1. If $\frac{1}{2}$ a man's age is 9 years, what is $\frac{1}{3}$ of his age?
2. If $\frac{1}{2}$ a man's age is 12 years, what is $\frac{1}{4}$ of his age?
3. If $\frac{1}{3}$ a man's age is 8 years, what is $\frac{1}{4}$ of his age?
4. If $\frac{1}{3}$ a man's age is 10 years, what is $\frac{1}{5}$ of his age?
5. If $\frac{1}{4}$ a man's age is 9 years, what is $\frac{1}{3}$ of his age?
6. If $\frac{1}{4}$ a man's age is 12 years, what is $\frac{1}{6}$ of his age?
7. If $\frac{1}{5}$ a man's age is 8 years, what is $\frac{1}{4}$ of his age?
8. If $\frac{1}{5}$ a man's age is 12 years, what is $\frac{1}{6}$ of his age?
9. If $\frac{1}{6}$ of my money is $ 6, what is $\frac{1}{4}$ of it?
10. If $\frac{1}{6}$ of my money is $12, what is $\frac{1}{9}$ of it?
11. If $\frac{1}{7}$ of my money is $ 9, what is $\frac{1}{9}$ of it?
12. If $\frac{1}{7}$ of my money is $12, what is $\frac{1}{12}$ of it?
13. If $\frac{1}{8}$ of my money is $ 9, what is $\frac{1}{12}$ of it?
14. If $\frac{1}{9}$ of my money is $ 4, what is $\frac{1}{6}$ of it?
15. If $\frac{1}{9}$ of my money is $ 8, what is $\frac{1}{12}$ of it?
16. If $\frac{1}{10}$ of my money is $ 9, what is $\frac{1}{9}$ of it?
17. If $\frac{1}{2}$ of my money is $ 9, what is $\frac{2}{3}$ of it?
18. If $\frac{1}{2}$ of my money is $12, what is $\frac{3}{4}$ of it?
19. If $\frac{1}{3}$ of my money is $ 8, what is $\frac{3}{4}$ of it?
20. If $\frac{1}{3}$ of my money is $10, what is $\frac{3}{5}$ of it?
21. If $\frac{1}{4}$ of my money is $ 9, what is $\frac{2}{3}$ of it?
22. If $\frac{1}{4}$ of my money is $12, what is $\frac{5}{6}$ of it?
23. If $\frac{1}{5}$ of my money is $ 8, what is $\frac{3}{4}$ of it?
24. If $\frac{1}{5}$ of my money is $12, what is $\frac{5}{6}$ of it?
25. If $\frac{1}{6}$ of my money is $ 6, what is $\frac{3}{4}$ of it?
26. If $\frac{1}{6}$ of my money is $12, what is $\frac{2}{9}$ of it?
27. If $\frac{1}{7}$ of my money is $ 9, what is $\frac{5}{9}$ of it?
28. If $\frac{1}{7}$ of my money is $12, what is $\frac{5}{12}$ of it?
29. If $\frac{1}{8}$ of my money is $ 9, what is $\frac{7}{12}$ of it?
30. If $\frac{1}{9}$ of my money is $ 4, what is $\frac{5}{6}$ of it?
31. If $\frac{1}{9}$ of my money is $ 8, what is $\frac{5}{12}$ of it?
32. If $\frac{1}{10}$ of my money is $ 8, what is $\frac{5}{8}$ of it?

1. 6 is $\frac{2}{3}$ of____.
2. 6 is $\frac{3}{5}$ of____.
3. 8 is $\frac{2}{3}$ of____.
4. 9 is $\frac{3}{4}$ of____.
5. 10 is $\frac{2}{3}$ of____.
6. 10 is $\frac{2}{5}$ of____.
7. 10 is $\frac{2}{9}$ of____.
8. 12 is $\frac{2}{3}$ of____.
9. 12 is $\frac{3}{4}$ of____.
10. 12 is $\frac{4}{5}$ of____.
11. 12 is $\frac{6}{7}$ of____.
12. 14 is $\frac{2}{3}$ of____.
13. 14 is $\frac{2}{5}$ of____.
14. 14 is $\frac{2}{7}$ of____.
15. 14 is $\frac{2}{9}$ of____.
16. 15 is $\frac{3}{5}$ of____.
17. 15 is $\frac{3}{7}$ of____.
18. 15 is $\frac{5}{6}$ of____.
19. 15 is $\frac{5}{7}$ of____.
20. 16 is $\frac{2}{3}$ of____.
21. 16 is $\frac{2}{5}$ of____.
22. 16 is $\frac{2}{7}$ of____.
23. 16 is $\frac{2}{9}$ of____.
24. 16 is $\frac{4}{5}$ of____.
25. 16 is $\frac{4}{7}$ of____.
26. 16 is $\frac{4}{9}$ of____.
27. 16 is $\frac{8}{9}$ of____.
28. 18 is $\frac{2}{3}$ of____.
29. 18 is $\frac{2}{5}$ of____.
30. 18 is $\frac{2}{7}$ of____.
31. 18 is $\frac{2}{9}$ of____.
32. 18 is $\frac{3}{4}$ of____.
33. 18 is $\frac{3}{5}$ of____.
34. 18 is $\frac{3}{7}$ of____.
35. 18 is $\frac{3}{8}$ of____.
36. 18 is $\frac{6}{7}$ of____.
37. 20 is $\frac{4}{5}$ of____.
38. 20 is $\frac{4}{7}$ of____.
39. 20 is $\frac{4}{9}$ of____.
40. 20 is $\frac{5}{6}$ of____.
41. 20 is $\frac{5}{7}$ of____.
42. 20 is $\frac{5}{8}$ of____.
43. 20 is $\frac{5}{9}$ of____.
44. 22 is $\frac{2}{3}$ of____.
45. 22 is $\frac{2}{5}$ of____.
46. 22 is $\frac{11}{12}$ of____.
47. 24 is $\frac{2}{3}$ of____.
48. 24 is $\frac{2}{5}$ of____.
49. 24 is $\frac{2}{7}$ of____.
50. 24 is $\frac{3}{4}$ of____.
51. 24 is $\frac{3}{5}$ of____.
52. 24 is $\frac{4}{5}$ of____.
53. 24 is $\frac{4}{7}$ of____.
54. 24 is $\frac{4}{9}$ of____.
55. 25 is $\frac{5}{6}$ of____.
56. 25 is $\frac{5}{7}$ of____.
57. 25 is $\frac{5}{9}$ of____.
58. 26 is $\frac{2}{3}$ of____.
59. 26 is $\frac{2}{5}$ of____.
60. 26 is $\frac{2}{7}$ of____.
61. 26 is $\frac{2}{9}$ of____.
62. 27 is $\frac{3}{4}$ of____.
63. 27 is $\frac{3}{5}$ of____.
64. 27 is $\frac{3}{7}$ of____.

ADDITION is the operation of finding the sum of two or more like numbers. The numbers added are called *addends*.

The *sum* of two or more numbers is a number containing as many units as are contained in all the numbers taken together.

A *sign*, in arithmetic, is a mark which indicates an operation to be performed, or which is used to shorten an expression.

The *sign of addition*, +, called *plus*, denotes that the numbers between which it stands are to be added: thus, 3+2 are 5.

The *sign of equality*, =, signifies that the numbers between which it stands are equal to each other: thus, 4 pk.=1 bu.; that is, 4 pk. are equal to 1 bu.

The *sign for dollars*, $, is written before the figures with which it is placed: thus, $10 represents ten dollars.

An entire expression of an equality of numbers or combination of numbers is called an *equation:* thus, 6+3=9.

1. Find the sum of 769 and 487.

SOLUTION.

769
487
1256

Write the numbers so that units of the same order are in the same column. First add units' column: 7 and 9 are 16; write 6 below in units' place, and add the one ten to the column of tens. Then add the tens' column: 1 and 8 and 6 are 15 tens; write the 5 below in the column of tens, and add the one hundred to the next column. Then add the hundreds' column: 1 and 4 and 7 are 12 hundreds; write the 12 below, making the entire sum 1256.

Arrange in columns and add —

2. $12.35, $23.45, $9.25, $150, $.75, and $17.75.
3. $209.10, $125.65, $175.50, $1.75, $1.75, and $.85.

In addition the pupil should —

1. Add the column both ways to test the work.
2. Combine numbers so as to add by ten when possible.
3. Shorten the work by multiplying, when a figure is repeated several times.
4. Begin at the left, when adding horizontally, since the eye more readily moves from left to right.

Write in columns properly, and add —

1. 24, 236, 238, 1234.
2. 34, 128, 257, 500.
3. 42, 1728, 526, 100.
4. 356, 101, 159, 3003.
5. 71, 208, 2029, 490.
6. 420, 202, 479, 1209, 54.
7. 92, 129, 278, 2309, 3001.
8. 19, 490, 386, 2300, 2927.
9. 919, 538, 2400, 907, 7075.
10. 416, 820, 379, 4729, 3375.

11. 3456, 4567, 3678.
12. 3579, 2468, 9753.
13. 908, 8207, 4790.
14. 890, 9870, 789.
15. 7096, 7690, 4653.
16. 3251, 1567, 9183.
17. 783, 2971, 1902.
18. 8787, 8686, 8989.
19. 9324, 9545, 9676.
20. 1718, 3738, 5758.

	21.	**22.**	**23.**	**24.**	**25.**
26.	298+	1029+	428+	296+	49=?
27.	4376+	76+	5061+	98+	1311=?
28.	907+	237+	19+	402+	205=?
29.	25+	4196+	1279+	13+	15=?
30.	128+	703+	499+	720+	146=?

	31.	**32.**	**33.**	**34.**	**35.**
36.	9+	207+	75+	209+	1712=?
37.	79+	426+	782+	29+	5726=?
38.	4327+	4127+	426+	1048+	209=?
39.	6214+	728+	350+	216+	8702=?
40.	903+	4019+	2407+	90+	435=?

1. A Week's Mail at a Post-Office.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Total.
Ordinary letters	9234	5785	4987	6432	5827	4983	____
Registered letters	588	436	392	275	665	399	____
Postal cards	2345	2734	3104	2593	2008	3017	____
Books	376	411	288	365	189	291	____
Parcels	1007	987	1205	988	1087	1205	____
Newspapers	9027	5476	1817	1121	1006	8705	____
Total	____	____	____	____	____	____	____

2. Attendance at a Public School.

	Jan.	Feb.	March.	April.	May.	June.	Total.
First grade	4752	4593	4409	4678	4704	4438	____
Second grade	4582	4437	4206	4491	4505	4527	____
Third grade	3512	3522	3389	3397	3402	3429	____
Fourth grade	2918	3057	2988	3046	3008	2978	____
Fifth grade	2705	2386	2378	2401	2419	2402	____
Sixth grade	1832	1857	1839	1850	1819	1809	____
Seventh grade	1508	1512	1498	1487	1476	1460	____
Eighth grade	1214	1267	1287	1252	1209	1187	____
Total	____	____	____	____	____	____	____

3. Weekly Report of a Public Library.

	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Total.
Fiction	566	578	549	408	499	618	____
History	488	472	465	411	398	527	____
Biography	532	513	509	450	411	519	____
Science	251	256	242	217	206	228	____
Poetry	551	516	509	488	439	571	____
Religion, etc	207	156	172	129	99	214	____
Total	____	____	____	____	____	____	____

Refer to your geography and find the total —

1. Population of the New England States.
2. Population of the states bordering the Great Lakes.
3. Population of the five largest cities of the United States.
4. Population of the five largest cities in the world.
5. Length of the five longest rivers in the world.
6. Area of the New England States.
7. Area of the states bordering on the Pacific Ocean.
8. Area of the states bordering on the Great Lakes.

9. Make an original problem from facts taken from the geography.

Add from dictation —

10. 21, 39, 14, 26, 44, 50, 16, 22, 88.
11. 19, 23, 32, 24, 42, 17, 53, 33, 77.
12. 31, 23, 42, 34, 61, 17, 82, 44, 66.
13. 15, 65, 29, 41, 80, 27, 43, 45, 65.

14. Explain how to write a column of figures for addition.
15. Which column is first added? Why?
16. How is the sum of a column written when it is greater than ten?
17. Write the rule for addition.

PRINCIPLES.

1. A number expresses a collection of units.

2. The sum of several numbers is equal to the sum of all their parts.

3. Only units of the same order can be added; that is, units to units, tens to tens, etc.

4. Only like numbers can be added; as, dollars to dollars, bushels to bushels, etc.

SUBTRACTION is the operation of finding the difference between two like numbers.

The *minuend* is the greater of the two numbers.

The *subtrahend* is the less of the two numbers.

The *difference*, or *remainder*, is what is left after subtraction.

The sign of subtraction, —, is called *minus*. It means *less*, and when placed between two numbers, it shows that the one on the right is to be taken from the one on the left. Thus, 15—6=9 shows that 6 is taken from 15, which leaves 9 for a remainder.

1. From 869 take 327.

SOLUTION.

Place the numbers so that the units of the same order may fall in the same column. Beginning with the lowest order, take units from units; then, tens from tens; then, hundreds from hundreds; and find the remainder to be 542.

869 Minuend.
327 Subtrahend.
542 Remainder.

2. From 483 take 257.

SOLUTION.

Minuend, 483
Subtrahend, 257
Remainder, 226

As we cannot take 7 units from 3 units, one of the 8 tens is put with the 3 units, making 13 units, and then, 7 units from 13 units leave 6 units. Now, as one of the 8 tens has been put with the 3 units, only 7 tens remain in the minuend, and 5 tens from 7 tens leave 2 tens, and finally, 2 hundreds from 4 hundreds leave 2 hundreds; hence the entire remainder is 2 hundreds, 2 tens, 6 units, or 226.

In the following examples the amount of a bank deposit is followed by the amount of the checks issued. Put down the amount of the deposit, and subtract the amount of each check in order, one at a time, putting down each balance.

1. Deposit, $ 427.85. Checks, $ 4.75, $ 6.90, $10.00.
2. Deposit, $ 729.63. Checks, $214.25, $86.15, $ 2.75.
3. Deposit, $ 942.21. Checks, $152.10, $23.80, $74.25.
4. Deposit, $ 896.43. Checks, $414.80, $29.50, $75.65.
5. Deposit, $ 672.75. Checks, $ 23.50, $19.45, $75.40.

Consult your history and tell how many years—

6. Since George Washington died.
7. Since Columbus discovered America.
8. Since the "Declaration of Independence."
9. Since the "Landing of the Pilgrim Fathers."
10. Since the "Boston Tea-Party."

11. Maine is how much greater in area than the other New England States?

12. The highest mountain in Asia is how much higher than the highest mountain in America?

13. The highest mountain in America is how much higher than the highest mountain in Europe?

14. How are numbers written for subtraction?

15. Which column is subtracted first? Why?

16. If the figure in the subtrahend is greater than that of the minuend, what is the process?

17. Write the rule for subtraction.

PRINCIPLES.

1. Like units alone can be subtracted.
2. The difference added to the less number gives the greater.

MULTIPLICATION is the operation of taking one number as many times as there are units in another.

The *multiplicand* is the number to be taken.

The *multiplier* denotes how many times the multiplicand is to be taken.

The *product* is the result of the multiplication.

A *composite number* is one produced by multiplying two or more integers together.

A *factor* is one of the integers which are multiplied together to form a composite number.

Distinguish *factor* from *part.* Is 10 a part of 12? Is it a factor?

After multiplication, the product is a composite number, of which the multiplier and multiplicand are factors.

Multiplication is but a short method of adding equal addends. For if the multiplicand be written as many times as there are units in the multiplier, and the numbers added, the sum will be equal to the product of the multiplicand and multiplier.

The sign of multiplication, $\times$, shows that the two numbers between which it stands are to be multiplied together. The sign is sometimes read *times;* as $3\times\$5=\$15$ is read, 3 times \$5 are \$15. The sign is also often read *multiplied by;* as, $\$5\times3=\$15$ is read, \$5 multiplied by 3 are \$15.

1. How many quarts in 4 bushels?

ADDITION.	MULTIPLICATION.	SOLUTION.
32 qt.	32 qt.	Four times 2 units are 8 units.
32 qt.	4	Write the 8 in units' place of the pro-
32 qt.	128 qt.	duct. Four times 3 tens are 12 tens,
32 qt.		or 1 hundred and 2 tens, which with
128 qt.		the 8 units give 128 for the product.

1. Multiply 458 by 346.

SOLUTION.

Multiplicand,	458
Multiplier,	346
Partial products,	2748
	1832
	1374
Product,	158468

The numbers are written so that units of the same order are in the same column.

The multiplicand is then multiplied by the 6 units, which gives 2748. It is then multiplied by the 4 tens, and the first figure of the product is written in column of tens. It is then multiplied by the 3 hundreds, and the first figure of the product is written in the column of hundreds.

The partial products are added for the complete product.

2. Multiply $179.35 by 384.

NOTE. — In multiplying United States money, or when the multiplicand has a decimal, care must be taken to point off as many decimal places as there are decimal places in the multiplicand.

3.	4.	5.	6.
$8704.04	$69.47	$481.69	$749.97
412	236	348	596

7.	8.	9.	10.
$67.49	$219.86	$67.492	$890.46
704	940	5320	436

11.	12.	13.
$87.05	$95.05	$946.27
3204	3992	9809

Multiply —

14. $44.36 by 58.	**17.** $ 99.88 by 189.	**20.** $995.58 by 736.
15. 534.6 by 93.	**18.** $775.85 by 673.	**21.** 300.7 by 408.
16. 789 by 49.	**19.** $ 39.75 by 178.	**22.** 289.19 by 197.

To multiply a number by 10, annex one cipher to the number; to multiply by 100, annex two ciphers; to multiply by 1000, annex three ciphers; and so on. Thus, $75\times10=750$; $75\times100=7500$; $75\times1000=75000$.

If the digits of the multiplier are greater than 1, first multiply, and then annex the ciphers. If both factors end in ciphers, multiply the digits, and annex as many ciphers as there are at the right of both factors.

1. Multiply 29 by 10; by 100; by 1000.
2. Multiply 429 by 10; by 20; by 200.
3. Multiply 720 by 20; by 30; by 300.
4. Multiply 1230 by 30; by 40; by 400.
5. Multiply 7500 by 40; by 50; by 500.
6. Multiply 1600 by 50; by 60; by 700.
7. Multiply 2550 by 70; by 80; by 800.
8. Multiply 3450 by 70; by 80; by 900.
9. Multiply 5670 by 80; by 90; by 9000.

When the multiplier is a composite number, it is sometimes convenient to separate it into its factors, and multiply by its factors in succession. The last product will be the one desired. Thus, 78 multiplied by 48 equals $78\times6\times8$.

Multiply by the most convenient method —

10. 96×42	**17.** 465×44	**24.** 485×467
11. 413×21	**18.** 394×64	**25.** 1802×202
12. 88×56	**19.** 427×78	**26.** 1967×456
13. 124×55	**20.** 594×90	**27.** 1902×716
14. 234×45	**21.** 459×67	**28.** 2732×607
15. 346×32	**22.** 673×86	**29.** 3576×508
16. 467×36	**23.** 927×79	**30.** 4839×719

A *bill* is an account of goods sold, of services rendered, or money paid, with the dates, prices, and amount.

A *debt* is what is due from one person to another.

A *debtor* is a person from whom a debt is due.

A *creditor* is a person to whom a debt is due.

To receipt a bill is to write on the bill, usually at the bottom of the statement, the words "Received payment," or "Paid," followed by the creditor's name, or by the name of some person authorized to receipt the account.

A bill is extended by writing the amount of each item in a column.

A bill is footed by finding the sum of the column extended.

Copy, extend, foot, and receipt the following bills:—

SAN FRANCISCO, CAL., July 15, 1902.

MR. HARRY BROWNE.

Bought of ALBERT BASH, Grocer.

July 1	4½ lb. Butter	@ $.20		
" 2	2 doz. Eggs	@ .35		
" "	2 lb. Coffee	@ .40		
" "	2 lb. Raisins	@ .15		
			$	

SAN FRANCISCO, CAL., Aug. 1, 1902.

MR. HENRY ROGERS.

Bought of THE PACIFIC CLOTHING HOUSE.

July 15	6 Collars	@ $ .25		
" "	1 pr. Gloves	@ 1.50		
" "	1 Hat	@ 4.50		
			$	

In the following exercises find the total value of the articles, and copy the work neatly, in the form of a bill or statement.

1.

215 lb.	butter,	at	$.20
100 lb.	cheese,	at	.15
115 doz.	eggs,	at	.15
223 qt.	milk,	at	.06
127 bu.	potatoes,	at	.65
132 bu.	carrots,	at	.60

2.

113 bu.	wheat,	at	$1.20
217 bu.	barley,	at	1.10
320 bu.	oats,	at	.45
715 bu.	rye,	at	.95
320 bu.	peas,	at	.75
126 bu.	corn,	at	.30

3.

100 bu.	turnips,	at	$.50
115 bu.	beets,	at	.80
120 bu.	parsnips,	at	.90
215 bu.	onions,	at	.95
240 bu.	tomatoes,	at	.45
135 doz.	cabbages,	at	.50

4.

25 lb.	rice,	at	$.05
35 lb.	tapioca,	at	.15
48 lb.	sago,	at	.12½
35 lb.	barley,	at	.05
45 lb.	apples,	at	.10
35 lb.	prunes,	at	.08

5.

200 bbl.	apples,	at	$2.25
420 bu.	plums,	at	1.20
123 bu.	peaches,	at	1.75
215 bu.	cherries,	at	1.35
220 bu.	pears,	at	1.50
120 bu.	quinces,	at	1.40

6.

25 lb.	sugar,	at	$.06
30 lb.	tea,	at	.45
80 lb.	coffee,	at	.35
60 lb.	raisins,	at	.09
40 lb.	currants,	at	.09
50 lb.	rice,	at	.06

7. Make a bill for all books used in your grade.

8. Make a bill for "Æsop's Fables," "Swiss Family Robinson," "Robinson Crusoe," and "Tanglewood Tales."

9. Make a bill of five items bought at a grocery.

10. Make a bill of five items bought at a clothing-store.

Find the proper "change" in the following transactions:—

1. 5 lb. coffee @ 35¢; 5 lb. sugar @ 9¢; 5 lb. cheese @ 14¢; money received in payment, $5.

2. 2 lb. beef @ 19¢; 2 lb. butter @ 40¢; radishes, 10¢; money received in payment, $2.

3. 3 lb. soap @ 10¢; 2 lb. starch @ 12¢; 1 paper allspice, 12¢; money received in payment, $1.

4. 2 lb. tea @ 90¢; 4 lb. sugar @ 10¢; 1 qt. strawberries, 25¢; money received in payment, $3.

5. 1 lead-pencil, 10¢; envelopes, 10¢; 1 daily paper, 5¢; money received in payment, $5.

6. 5 yd. muslin @ 13¢; 3 spools cotton @ 6¢; 6 handkerchiefs @ 25¢; money received in payment, $4.

7. 900 lb. pork @ 3¢; 5 bu. peaches @ $2.50; 7 bu. apples @ 75¢; money received in payment, $50.

8. 18 bu. oats @ 50¢; 12 bu. corn @ 75¢; 13 cwt. hay @ $1.25; money received in payment, $35.

9. 3 pk. peaches @ 50¢ per bu.; 5 qt. cherries @ 16¢; 2 lb. butter @ 35¢; money received in payment, $5.

10. How are numbers written for multiplication?

11. By which figure do you first begin to multiply?

12. How are the partial products written?

PRINCIPLES.

1. The multiplier is always an abstract number.

2. The product is of the same kind as the multiplicand.

3. The product of several factors is the same, regardless of the order in which they are taken.

4. Adding one to either factor adds the other factor to the product; subtracting one from either factor takes the other factor from the product.

DIVISION is the operation of finding how many times one number is contained in another, or of dividing a number into equal parts.

The *dividend* is the number to be divided.

The *divisor* is the number by which we divide. It is (*a*) the standard which measures the dividend; or (*b*) it shows into how many equal parts the dividend is to be divided.

The *quotient* is the result of division. It shows (*a*) how many times the divisor is contained in the dividend; or (*b*) the value of one of the equal parts of the dividend.

The *remainder* is what is left after the operation. When it is 0, the quotient is a whole number, and the division is exact.

There are always three numbers in every division, and sometimes four: 1. The dividend; 2. The divisor; 3. The quotient; 4. The remainder.

There are three methods of denoting division:—

$12 \div 3$ expresses that 12 is to be divided by 3;

$\frac{12}{3}$ expresses that 12 is to be divided by 3;

3)12 expresses that 12 is to be divided by 3.

SHORT DIVISION is the operation of dividing when the work is performed mentally, and the results, only, are written down.

LONG DIVISION is the operation of dividing when all the work is expressed.

Care should be taken to consider the relation of division to multiplication. Here is a question in multiplication: "If a man has 10 fields of equal size, each containing 12 acres, how many acres has he?"

To make a question of division, the problem must be changed to read: "A man has 120 acres of land, divided into 10 equal fields. How many acres in each field?"

1. Divide 1384 by 4.

SOLUTION. — SHORT DIVISION.

Divisor, 4)1384 Dividend.
Quotient, 346

Write the divisor and dividend as here written. The divisor is not contained in the 1 in thousands' place, but is contained in 13 hundreds 3 hundred times, with 1 hundred remaining. Write the 3 in hundreds' place in the quotient. Reduce the 1 hundred to tens; that is, call it 10 tens, and add it to the 8 tens. 4 is contained in 18 tens 4 tens times, with 2 tens remaining. Write the 4 in tens' place in the quotient. Reduce the 2 tens to units; that is, call it 20 units, and add it to the 4 units. 4 is contained in 24 units exactly six times. Write the 6 in units' place in the quotient, and the division is completed.

2. $432 \div 3 =$ ___	**14.** $309 \div 7 =$ ___	**26.** $2458 \div 2 =$ ___
3. $567 \div 4 =$ ___	**15.** $602 \div 5 =$ ___	**27.** $9400 \div 8 =$ ___
4. $456 \div 5 =$ ___	**16.** $800 \div 9 =$ ___	**28.** $4567 \div 5 =$ ___
5. $832 \div 6 =$ ___	**17.** $379 \div 4 =$ ___	**29.** $8765 \div 4 =$ ___
6. $472 \div 7 =$ ___	**18.** $1001 \div 9 =$ ___	**30.** $9463 \div 5 =$ ___
7. $500 \div 8 =$ ___	**19.** $4296 \div 3 =$ ___	**31.** $4407 \div 6 =$ ___
8. $600 \div 9 =$ ___	**20.** $6511 \div 8 =$ ___	**32.** $8371 \div 7 =$ ___
9. $946 \div 9 =$ ___	**21.** $6842 \div 7 =$ ___	**33.** $7654 \div 4 =$ ___
10. $458 \div 8 =$ ___	**22.** $5437 \div 8 =$ ___	**34.** $4902 \div 5 =$ ___
11. $534 \div 9 =$ ___	**23.** $4862 \div 9 =$ ___	**35.** $7493 \div 6 =$ ___
12. $462 \div 8 =$ ___	**24.** $3456 \div 8 =$ ___	**36.** $3874 \div 6 =$ ___
13. $700 \div 7 =$ ___	**25.** $5002 \div 7 =$ ___	**37.** $7496 \div 5 =$ ___

38. Find $\frac{1}{2}$ of 3725.
39. Find $\frac{1}{4}$ of 604.
40. Find $\frac{3}{4}$ of 7550.
41. Find $\frac{1}{3}$ of 7654.
42. Find $\frac{1}{4}$ of 4862.
43. Find $\frac{1}{3}$ of 1347.
44. Find $\frac{1}{5}$ of 1121.
45. Find $\frac{1}{6}$ of 5894.
46. Find $\frac{1}{7}$ of 925.
47. Find $\frac{1}{8}$ of 3069.

1. Divide 361299 by 72.

SOLUTION. — LONG DIVISION.

$5018\frac{3}{72}$ For convenience, write the divisor

72)361299 at the left of the dividend. Take as

$72\times5=$ 360 many figures as are required to con-

129 tain the divisor. 72 is not contained

$72\times1=$ 72 in 3, nor in 36; it is contained in 361

579 five times. Write 5 in the quotient as

$72\times8=$ 576 the first figure.

Remainder= 3 Multiply the divisor by 5; place the product under 361, and subtract. The remainder is 1, which (as in short division) we prefix, by bringing down 2, the next figure of the dividend.

Repeat the same steps. 72 in 12, 0 times. Write 0 in the quotient, and bring down 9, the next figure of the dividend. 72 in 129, once. Write 1 in the quotient, multiply the divisor by it, and subtract the product from 129. The remainder is 57, to which bring down the next figure, 9.

Repeat again the same steps. 72 in 579, 8 times. Write 8 in the quotient, multiply the divisor by it, and subtract. There is a remainder of 3. All the figures of the dividend having been brought down, the work is finished. Write the remainder over divisor as a fractional part of the quotient.

The numbers 361, 129, and 579 are partial dividends. If, when multiplied, the product is greater than the partial dividend, the quotient figure is too great; and if the remainder is greater than the divisor, the quotient figure is too small.

6	Thus, if we say that 72 is contained	4
72)361299	6 times in 361, the product is greater	72)361299
432	than the partial dividend, and the	288
	quotient must be diminished. And	73

if we say it is contained 4 times, the remainder is greater than the divisor, and the quotient must be increased.

1.	13)988	13)6838	13)4524	13)2548	13)44928
2.	14)1568	14)2436	14)21448	14)24864	14)2692
3.	15)2550	15)2910	15)13370	15)14070	15)19440
4.	16)1792	16)2496	16)11072	16)21920	16)25248
5.	17)2176	17)2958	17)15912	17)22236	17)29920
6.	18)3240	18)2736	18)16456	18)23580	18)31572
7.	19)1824	19)2888	19)12388	19)25688	19)30742
8.	20)3160	20)3920	20)8040	20)32680	20)27120
9.	42)8820	42)16380	42)25536	42)32298	42)37216
10.	44)3872	44)19008	44)28908	44)35596	44)39952
11.	46)3910	46)4508	46)12328	46)35374	46)42228
12.	48)3888	48)4368	48)15024	48)32448	48)41232
13.	50)12500	50)2400	50)18450	50)40900	50)47900
14.	48)43248	48)5232	48)29040	48)40608	48)38160
15.	38)3648	38)23408	38)34504	38)27550	38)10180

1. Divide 2304 by 24, using the factors 4 and 6.

SOLUTION.

4)2304
6)576
96

To *multiply* by 24, we may multiply by 4, and then multiply that product by 6. Hence, to *divide* by 24, we may divide by 4, and then divide that quotient by 6. Dividing by 4 gives a quotient of 576. Dividing this by 6 gives 96 for the quotient desired. Prove the work by finding $96 \times 6 \times 4$.

2. $8528 \div 16 =$ ___
3. $3456 \div 18 =$ ___
4. $14352 \div 42 =$ ___
5. $47328 \div 32 =$ ___
6. $3690 \div 15 =$ ___
7. $7280 \div 35 =$ ___
8. $33656 \div 28 =$ ___
9. $56592 \div 27 =$ ___
10. $30156 \div 28 =$ ___
11. $25785 \div 45 =$ ___
12. $79344 \div 72 =$ ___
13. $3528 \div 24 =$ ___
14. $6228 \div 36 =$ ___
15. $15625 \div 125 =$ ___

16. How are numbers written for division?
17. How is the first partial dividend found?
18. Where is the quotient written?
19. What numbers are then multiplied?
20. What numbers are then subtracted?
21. How is the next partial dividend determined?
22. How is the last remainder written in the quotient?
23. Write the rule for division.

Mental exercises from dictation—

24. $12, -3, -5, +6, -7, +9, \times 2, +6, \div 3, +8 = ?$
25. $3, \times 2, +4, \times 3, \div 5, +3, \times 2, \div 9, \times 4, -7 = ?$
26. $4, \times 3, +3, \div 5, +6, \times 2, +4, \div 11, +6, \times 2 = ?$
27. $7, \times 3, -5, \div 4, +1, \times 8, \div 10, \times 3, +2, \div 7 = ?$

The quotient expresses the relation between the dividend and the divisor, and is changed with each change in this relation. To illustrate —

$$24 \div 6 = 4.$$

What is the effect on the quotient —

If the dividend is multiplied by 2?

If the divisor is multipled by 2?

If both dividend and divisor are multiplied by 2?

If the dividend is divided by 2?

If the divisor is divided by 2?

If both dividend and divisor are divided by 2?

If the dividend and the divisor are like numbers, what kind of a number will the quotient be? (*Example.* — $\$24 \div \$6 = ?$)

If the dividend is concrete, and the divisor is not, what kind of a number will the quotient be? (*Example.* — $\$24 \div 6 = ?$)

How is the dividend found when the divisor and quotient are given?

Correct answers to the above questions establish the following

PRINCIPLES.

1. Any change in the divisor, by multiplication or by division, makes an opposite change in the quotient.

2. Any change in the dividend, by multiplication or division, makes a similiar change in the quotient.

3. Multiplying or dividing both dividend and divisor by the same number does not change the quotient.

4. When the dividend and divisor are like numbers, the quotient is an abstract number.

5. When the divisor is an abstract number, the quotient and dividend are like numbers.

1. How many hours in 1 month 1 week 1 day?

2. How many strokes does a clock make in 12 hours?

3. If 96 acres of oats produce 3360 bushels, what is the average yield per acre?

4. A grocer bought 87 bushels of potatoes at 50 cents a bushel, and retailed them for 15 cents a peck. How much did he gain?

5. A man receives a salary of $95 a month, and pays $18 a month for room rent, and $45 a month for all other expenses. How much can he save in 2 years?

6. A man paid $33,360 for 24 city lots. What was the average price per lot?

7. A boy bought a bushel of nuts for $3, and sold them at 10 cents a pint. How much did he gain?

8. If 5 yards of ribbon cost 65 cents, what will 9 yards cost?

9. If $2.16 is divided equally among 9 boys, what amount will each receive?

10. Four boys share $3.36 as follows: The first takes $\frac{1}{6}$ of it, the second takes $\frac{1}{4}$ of what was left, the third takes $\frac{1}{2}$ of what was then left, and the fourth takes the remainder. State each boy's share.

11. A man sold his farm for $6,375. After paying his debts, he had $4,015 left. State the amount of his debts.

12. A man owes to one person $302, to another he owes $607; he has due him from others $2,000, and has $1,260 on hand. What amount has he after paying his debts?

13. A farmer sold wheat for $103, corn for $60, butter for $51, cheese for $120, and cattle for $605. From his receipts he paid $1000 for more land, $45 for a new wagon, $175 for improvements, and $290 for labor. How much money had he left?

Illustrate by an example each of the following problems: —

1. Given several numbers, to find their sum.

2. Given the sum of several numbers, and all of them but one, to find that one.

3. Given the parts, to find the whole.

4. Given the whole and all the parts but one, to find that one.

5. Given the greater of two numbers and their difference, to find the less.

6. Given the less of two numbers and their difference, to find the greater.

7. Given the minuend and subtrahend, to find the remainder.

8. Given the minuend and remainder, to find the subtrahend.

9. Given the subtrahend and remainder, to find the minuend.

10. Given the product and one of two factors, to find the other factor.

11. Given the multiplicand and multiplier, to find the product.

12. Given the product and multiplicand, to find the multiplier.

13. Given the product and multiplier, to find the multiplicand.

14. Given the divisor and dividend, to find the quotient.

15. Given the divisor and quotient, to find the dividend.

16. Given the dividend and quotient, to find the divisor.

17. Given the dividend, quotient, and remainder, to find the divisor.

18. Given the divisor, quotient, and remainder, to find the dividend.

NOTATION is the method of writing numbers.

NUMERATION is the method of reading numbers.

There are three methods of expressing numbers,—

1. The word method; as, one, two, three, etc.
2. The Arabic method; as, 1, 2, 3, 4, 5, etc.
3. The Roman method; as, I, II, III, IV, etc.

The *Arabic notation* is the method of expressing numbers by figures. Ten figures are used: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. The 0 is called naught, or cipher. It denotes the absence of number. The other nine figures are called significant figures, or digits.

The number *ten* is expressed by writing 0 on the right of 1; thus, 10. This 10 equals ten of the units expressed by 1. It is, however, but a single ten, and may be regarded as a unit ten times as great as the unit 1. It is called a unit of the *second order*.

Ten units of the second order, or ten tens, form a unit of the *third order*, called a hundred, represented by writing the figure 1 with two ciphers after it; thus, 100.

Orders of units are denoted by the position of the figures used in expressing a number. Thus 235 represents 5 units of the first order, 3 units of the second order, or 3 tens, and 2 units of the third order, or 2 hundreds; and is read, two hundred thirty-five.

Numbers containing more than three figures are separated into *periods* of three figures each, beginning with the right, or units' column.

Figures have two values,—a *simple* value and a *local* value. The simple value of a figure is its value when it stands alone, or in units' order. The local value arises from the order in which it is written, and increases from the right to the left by a scale of ten.

1. In the number 222, how many times is the second figure from the right greater than the right-hand figure? How many times is the third figure greater than the right-hand figure? How many times greater is the third figure than the second? How many times is the right-hand figure contained in the second? How many times is the right-hand figure contained in the third? How many times is the second figure contained in the third?

2. In the number 203, of what use is the cipher? Why is there no cipher at the left of the 2? If the cipher were omitted, what would the number be? If another cipher were written by the side of the first, what change would be made in the value of the 2? What change would be made in the value of the 3? If a cipher were written after the 3, what effect would be produced on the 3? What effect would be produced on the 2?

3. In the number 1014, the 1 at the left is how many times greater than the 1 at the right of the cipher? If another cipher were written between the two 1's, what figure would be changed in value? If a cipher were written between the 1 and the 4, what figures would be changed in value?

4. In the number 1560, what effect would be produced by writing a cipher at the left of the 1? Between the 1 and 5? Between the 5 and 6?

5. In the number 4060, would the value of the 6 be changed if the 4 were omitted? Would the value of the 4 be changed if the 6 were omitted? What change in the value of the number would be produced by omitting the cipher between the 4 and 6? What change in the value of the number would be produced by omitting the cipher at the right of the 6?

A DECIMAL is a number of *tenths, hundredths, thousandths*, etc., or a fraction whose denominator is 10 or some power of 10.

The denominator of a decimal fraction is indicated by a point written at the left of the numerator; thus, $.5=\frac{5}{10}$; $.05=\frac{5}{100}$; $.005=\frac{5}{1000}$. The point is called the *decimal point* or *separatrix.*

The method of expressing decimals arises from the method of decimal notation for integers. The law as applied to integers and fractions is shown in the following

NOTATION AND NUMERATION TABLE.

Ten millions.	Millions.	Hundred-thousands.	Ten-thousands.	Thousands.	Hundreds.	Tens.	Units.	Decimal point.	Tenths.	Hundredths.	Thousandths.	Ten-thousandths.	Hundred-thousandths.	Millionths.	Ten-millionths.
8	7	6	5	4	3	2	1	.	2	3	4	5	6	7	8

A PURE DECIMAL is one which consists of decimal figures only; as, .345.

A MIXED DECIMAL is one which consists of an integer and a decimal; as, 4.35. The word *and* is always read between the integer and the decimal. Thus, 4.35 is read 4 and 35 hundredths.

A COMPLEX DECIMAL is one which contains a common fraction at the right of the decimal; as, $.45\frac{1}{3}$.

Since the unit is the basis of all numbers, integral and fractional, the order of units is the starting-point or center of the system of notation and numeration of decimals, and is indicated by the decimal point (.), placed at the right of it.

The first order at the right of units is named *tenths*, each tenth being one tenth of a unit.

The second decimal place has the name *hundredths*, each hundredth being one tenth of a tenth.

The third decimal place has the name *thousandths*, each thousandth being one tenth of a hundredth.

Thus, 4.256 expresses four units, two *tenths*, five *hundredths*, six *thousandths;* or, in brief, four and two hundred fifty-six thousandths.

NOTE. — In reading numbers, use the conjunction *and* only after units' order, to show the place of the decimal point. In reading decimals, read the figures as if they were integers, and then give them the name of the right order.

Read at sight and copy from dictation —

1.	.003	**18.**	.1250
2.	.072	**19.**	.0008
3.	.0001	**20.**	7.6534
4.	.0055	**21.**	14.8765
5.	.0324	**22.**	0.3145
6.	.3145	**23.**	7.6432
7.	.1058	**24.**	14800.05
8.	.0105	**25.**	21.576
9.	.0035	**26.**	7432.09
10.	.0009	**27.**	103.043
11.	.0320	**28.**	727.185
12.	.080	**29.**	23.451
13.	.0606	**30.**	612945.601
14.	.2405	**31.**	9078654.327
15.	.0180	**32.**	15.5764
16.	.5003	**33.**	119.0001
17.	.0009	**34.**	900.00033

THE ROMAN NOTATION.

The ROMAN NOTATION, so called because it was used by the ancient Romans, employs seven letters: I denotes 1; V, 5; X, 10; L, 50; C, 100; D, 500; M, 1000.

These letters express numbers, according to the following principles:—

1. If a letter is repeated, its value is repeated. Thus, XX is twenty; III is three.

2. A letter of less value, placed after one greater, unites its value to that of the latter. Thus, VI is six.

3. A letter of less value, placed before one of greater, takes its value from that of the latter. Thus, IV is four.

4. A letter of less value, placed between two of greater, takes its value from that of the other two united. Thus, LIV is fifty-four.

5. A bar over a letter increases its value a thousand times. Thus, $\overline{V}$ is five thousand.

Roman numbers are now used chiefly to mark volumes, chapters, or lessons; to indicate the hours on clock or watch faces; for dates upon tombstones, tablets, etc.; and to designate the year of the Christian era.

I. One.	XXX. Thirty.	D. Five hundred.
II. Two.	XL. Forty.	DC. Six hundred.
III. Three.	L. Fifty.	DCC. Seven hundred.
IV. Four.	LX. Sixty.	DCCC. Eight hundred.
V. Five.	LXX. Seventy.	DCCCC. Nine hundred.
VI. Six.	LXXX. Eighty.	M. One thousand.
VII. Seven.	XC. Ninety.	MD. Fifteen hundred.
VIII. Eight.	C. One hundred.	MM. Two thousand.
IX. Nine.	CC. Two hundred.	$\overline{V}$. Five thousand.
X. Ten.	CCC. Three hundred.	$\overline{X}$. Ten thousand.
XX. Twenty.	CCCC. Four hundred.	$\overline{M}$. One million.

ADDITION OF DECIMALS is the operation of finding the sum of two or more decimal numbers.

As in addition of integers, only units of the same kind can be added. Therefore, in writing numbers for addition, figures having the same unit value are placed in the same column. Addition of decimals is then made in the same manner as addition of whole numbers.

1. Add: 7.8, 9.04, 5.714, 30.06, and .2345.
2. Add: 3.75, 47.075, .00875, and 100.05.
3. Add: 45.37, .375, 15.875, 1.5, and 10.05.
4. Add: 70.25, 9.125, 158,375, and .0005.
5. Add: 750.85, 5.075, .0375, and 1550.75.
6. Find the sum of 9 tenths, 19 hundredths, 9 hundredths, 19 thousandths, 9 ten-thousandths, and 25 millionths.
7. Find the sum of 2 and 25 thousandths, 125 and 17 ten-thousandths, 47 and 125 millionths, and 150 and 15 ten-millionths.
8. Find the sum of two hundred twenty-five thousandths, one hundred twenty and five hundred seventeen ten-thousandths, four hundred seventy-one and twenty-five millionths, and one hundred one ten-millionths.
9. Find the sum of five, fifty hundredths, five ten thousandths, five hundred-thousandths, fifty, and five and five thousandths.
10. Find the sum of twenty and two hundredths, two thousand four hundred sixty and seventy-five thousandths, and two hundred thirty-four thousandths.
11. Find the sum of sixty and eight hundredths, sixty-seven and thirteen thousandths, eleven and one hundred eleven ten-thousandths.

SUBTRACTION OF DECIMALS is the process of finding the difference between two decimal numbers.

1. From 5.45 subtract .545.

SOLUTION.

A cipher is annexed to the minuend to make the number of decimal places equal to the number in the subtrahend. Write units of the same order in the same column, and proceed as with integers.

$$\begin{array}{r} 5.450 \\ .545 \\ \hline 4.905 \end{array}$$

2. Find the difference between 57.5 and .575.
3. Find the difference between .3125 and 31.25.
4. Find the difference between 1750 and 17.5.
5. Find the difference between .7 and .0075.
6. Find the difference between 105 and .01075.
7. Find the difference between 1234.5 and 1.2345.
8. From three take three ten-thousandths.
9. From one thousand take one thousandth.
10. From twenty-five hundred take twenty-five hundredths.
11. From one hundred and twenty-five thousandths take one hundred twenty-five thousandths.
12. $1+.1-.01+10-.19+.5-10.4=?$
13. $2-.1+11-.11+1.1-.001+.22=?$
14. Count by .4 from .4 to 4, and back from 4 to .4.
15. Count by .6 from .6 to 6, and back from 6 to .6.
16. Count by .7 from .7 to 7, and back from 7 to .7.
17. Count by .8 from .8 to 8, and back from 8 to .8.
18. Count by .9 from .9 to 9, and back from 9 to .9.
19. Count by 1.5 from 1.5 to 15, and back from 15 to 1.5.
20. Count by 1.4 from 1.4 to 14, and back from 14 to 1.4.
21. Count by 1.3 from 1.3 to 13, and back from 13 to 1.3.

MULTIPLICATION OF DECIMALS is the process of finding the product of two numbers, one or both of which contain a decimal.

1. Multiply .4 by 6.

SOLUTION.

.4
6
2.4

As in integers, 6 times 4 tenths are 24 tenths. Reduced to the next higher order, it is read 2 and 4 tenths. As many decimal places are pointed off in the product as are in the multiplicand.

2. Multiply .4 by .6.

SOLUTION.

.4
.6
.24

If the 6 were an integer, the product would be 2.4; but .6 is one tenth as large as 6, and the product is therefore one tenth as large as 2.4, which is found by removing the decimal point one place to the left. As many decimal places are pointed off as are in both multiplier and multiplicand.

3. Multiply .75 by .03.

SOLUTION.

.75
.03
.0225

By multiplying by 3 as an integer, the product is 2.25. But as the multiplier is one hundredth of 3, the product is found by moving the decimal point two places to the left. It is necessary to prefix a cipher.

4. In the multiplication of decimals, how many decimal places are in the product?

5. Write the rule for the multiplication of decimals.

6. $.08 \times .03 \times .07 = ?$

DIVISION OF DECIMALS is the process of dividing when one or both terms are decimals.

Since in multiplication of decimals the product must have as many decimal places as are in both the multiplier and multiplicand, it follows that in division of decimals the dividend must contain as many decimal places as are in both divisor and quotient.

1. Divide .125 by 25.

SOLUTION.

25).125(.005 The dividend has three decimal places. The
125 divisor has none. The quotient must therefore have three. Ciphers are prefixed to fill the vacant orders.

2. Divide 12.5 by .25.

SOLUTION.

.25)12.50(50 Annexing ciphers to a decimal does not
12.5 change its value. Therefore annex ciphers to
0 the dividend until it has the same number of decimal places as are in the divisor. The dividend will then be 12.50, and the quotient will be a whole number.

3. Divide 72.96 by .8.

SOLUTION.

8)729.6 Multiplying both divisor and dividend by the
91.2 same number does not change the quotient. Hence, multiply both by 10, by moving the decimal point one place to the right. This makes the divisor an integer, and the quotient will have one decimal place.

1. 25÷5 =?	**9.** .025÷.5 =?	**17.** 4.6842 ÷2.11 =?
2. 25÷.5 =?	**10.** .025÷.05 =?	**18.** 33.66431÷.101 =?
3. 25÷.05 =?	**11.** .025÷.005=?	**19.** .010001 ÷.01 =?
4. 25÷.005=?	**12.** 48÷1.6 =?	**20.** .0625 ÷2.5 =?
5. 2.5÷5 =?	**13.** .48 ÷16 =?	**21.** .051 ÷.12 =?
6. 2.5÷.5 =?	**14.** .048÷.24 =?	**22.** 1.05 ÷14 =?
7. 2.5÷.05 =?	**15.** 24÷48 =?	**23.** 5.1435 ÷ 4.05=?
8. 2.5÷.005=?	**16.** 240÷4.8 =?	**24.** .46575 ÷31.05=?

25. How many decimal places must be in the quotient?
26. When are ciphers prefixed to the quotient?
27. When are ciphers annexed to the quotient?
28. Write the rule for division of decimals.

PRINCIPLES.

By annexing one cipher, .5 becomes .50;
By annexing two ciphers, .5 becomes .500;
By annexing three ciphers, .5 becomes .5000.

In which the local value is left unchanged, remaining in tenths' place.

By prefixing one cipher, .5 becomes .05;
By prefixing two ciphers, .5 becomes .005;
By prefixing three ciphers, .5 becomes .0005.

In which it is seen that each cipher prefixed removes the 5 to the next lower place, and hence changes it to one tenth of its former value. From this are readily derived the following principles: —

1. Annexing or removing ciphers at the right of a decimal does not alter its value.

2. Each removal of a decimal point one place to the right multiplies the value of the decimal by 10.

3. Each removal of a decimal point one place to the left divides the value of the decimal by 10.

1. What two numbers multiplied together make 6?
2. What are the factors of 15? Of 21? Of 22?
3. Is 3 a factor of 24? Is 5? Is 6? Is 8?
4. Of what numbers less than 50 is 6 a factor?
5. A number that has no factor is called a prime number. Name all the prime numbers less than 30.
6. What are the prime factors of 14? Of 35?
7. What prime factor is common to 14 and 35?
8. What prime factors are common to 16 and 24?
9. What is the largest factor of 16? Of 24?
10. What is the largest factor common to 16 and 24?
11. What is the largest factor common to 28 and 42?
12. What is the largest factor common to 16 and 36?
13. What is the largest factor common to 18 and 42?
14. What is the largest factor common to 72 and 30?
15. What is the largest factor common to 20 and 45?
16. What is the largest factor common to 75 and 125?
17. What is the largest factor common to 36 and 54?
18. What is the largest factor common to 14 and 63?
19. A number that contains a given factor is a multiple of that factor. What are the multiples of 7, less than 50?
20. What is the least multiple of 6? Of 9?
21. What is the least multiple common to 6 and 9?
22. What is the least multiple common to 3 and 4?
23. What is the least multiple common to 6 and 8?
24. What is the least multiple common to 5 and 7?
25. What is the least multiple common to 10 and 8?
26. What is the least multiple common to 10 and 12?
27. What is the least multiple common to 12 and 9?
28. What is the least multiple common to 12 and 15?
29. What is the least multiple common to 12 and 8?
30. What is the least multiple common to 6, 8, and 12?

PROPERTIES OF NUMBERS.

An *exact divisor* of a number is any integer, except 1 and the number itself, that will divide it without a remainder.

A number is *divisible* by another when there is no remainder after division.

A *factor* of a number is an exact divisor of the number.

An *even* number is one divisible by 2.

An *odd* number is one not divisible by two.

A number composed of two or more factors is called a *composite* number.

A number which has no factors is called a *prime* number.

The process of separating composite numbers into factors is called *factoring*.

The product obtained by using a number two or more times as a factor is called a *power* of that number. Thus, 16 is the product obtained by using 4 twice as a factor. The power is indicated by an *exponent*, a number written at the right and a little above the factor to indicate how many times a factor is used. Thus, $4^2=16$, which is read, 4 *second power* equals 16. Likewise, $4^3=64$, which is read, 4 *third power* equals 64.

A *common divisor* of two or more like numbers is a factor of each of them.

Numbers are *prime to each other* when they have no common factors.

The *greatest divisor* of two or more numbers is the largest factor common to them. It is usually indicated by G. C. D.

A *multiple* of any given number is a number of which the given number is a factor.

A *common multiple* is a multiple of two or more factors.

The *least common multiple* is the least multiple common to two or more factors. It is usually indicated by L. C. M.

1. Find the prime factors of 56.

SOLUTION.

2)56 Dividing this by a prime factor, the quotient is 14.
2)28 Dividing this by a prime factor, the quotient is 7,
2)14 which is also a prime number. The prime factors
7 of 56 are 2, 2, 2, and 7.

Find the prime factors of —

2. 84	**8.** 576	**14.** 3420
3. 144	**9.** 1008	**15.** 7800
4. 160	**10.** 2772	**16.** 1184
5. 210	**11.** 6105	**17.** 6300
6. 462	**12.** 1155	**18.** 4389
7. 426	**13.** 2800	**19.** 12496

20. Write the rule for finding the prime factors of a number.

21. Find the G. C. D. of 18, 30, and 48.

SOLUTION.

$18=2\times3\times3$
$30=2\times3\times5$
$48=2\times3\times2\times2\times2$
$2\times3=6$ Ans.

Factoring all the numbers, it is found that 2 and 3 are common factors to the numbers, and the only common factors. Their product is the G. C. D.

22. 132 and 144?	**29.** 462 and 693?
23. 49 and 72?	**30.** 511 and 748?
24. 35 and 70?	**31.** 412 and 596?
25. 78 and 91?	**32.** 218 and 654?
26. 36 and 72?	**33.** 48, 84, 108, and 114?
27. 40 and 75?	**34.** 75, 63, 100, and 40?
28. 84 and 97?	**35.** 81, 120, and 141?

1. Find the G. C. D. of 216 and 408.

SOLUTION.

216)408(1
216
192)216(1
192
24)192(8
192

The G. C. D. cannot be greater than the least number. If 216 will divide 408, it will be the G. C. D. By dividing, there is 192 for a remainder. The G. C. D. of 216 and 408 will also divide 192. If 192 will exactly divide 216, it will be the G. C. D. But there is a remainder of 24. The G. C. D. of 216, 408, and 192 will also divide 24. If 24 itself is the divisor, it will exactly divide 192. Since it divided 192 without a remainder, it is the G. C. D. of 216 and 408.

NOTE. — For three or more numbers, find the G. C. D. of two numbers, then for that divisor and the third number, and so on.

2. 15, 50, and 40.
3. 24, 18, and 144.
4. 50, 100, and 80.
5. 45, 75, 105, and 29.
6. 336 and 480.
7. 925 and 1475.
8. 1073 and 1537.
9. 3233 and 3551.
10. 883 and 1547.
11. 275 and 440.
12. 1215 and 1878.
13. 1071 and 1870.
14. 42 and 495.
15. 247 and 323.
16. 285 and 465.
17. 532 and 1274.
18. 221 and 495.
19. 413 and 931.

20. In one school there are 324 pupils, and in another there are 252 pupils. The two schools are divided into the largest possible classes of equal size. How many classes in each school, and how many pupils in each class?

21. Write two rules for finding the G. C. D.

1. Find the L. C. M. of 30, 42, and 66.

SOLUTION.

$30=2\times3\times5$
$42=2\times3\times7$
$66=2\times3\times11$
$2\times3\times11\times7\times5=2310$

The L. C. M. cannot be less than the largest number. It must therefore contain 66, and all the prime factors of 66, which are 2, 3, and 11. Also, it must contain the prime factors of 42, which are 2, 3, and 7. Since 2 and 3 are once used, the 7 is added as an additional factor. The 5 is also taken from the factors of 30. The product of these prime factors, 2, 3, 11, 7, and 5, is the L. C. M. of the given numbers.

2. Find the L. C. M. of 12, 30, and 70.

SOLUTION.

$$\begin{array}{r|lll} 2 & 12 & 30 & 70 \\ \hline 3 & 6 & 15 & 35 \\ \hline 5 & 2 & 5 & 35 \\ \hline & 2 & 1 & 7 \end{array}$$

Dividing by 2, it is found to be a factor of each of the numbers. It must also be a factor of the L. C. M. Likewise, 3 is found to be a factor of some of the numbers, and hence must be a factor of the L. C. M. Also, 5 is found to be a factor of some of the numbers, and hence a factor of the L. C. M. The last quotients, being the remaining prime factors of the numbers, must be factors of the L. C. M. Therefore, the L. C. M. must be $2\times3\times5\times2\times7=420$.

Find the L. C. M. of —

3. 24, 42, 27.
4. 21, 33, 56.
5. 63, 72, 84.
6. 5, 10, 15.
7. 16, 20, 30.
8. 28, 56, 84.
9. 2, 8, 12, 14.
10. 8, 12, 20, 30.
11. 10, 45, 75, 90.
12. 24, 42, 36, 64.
13. 72, 80, 84, 96.
14. 42, 49, 72, 88.

PRINCIPLES.

The principles on which is based the method of finding the G. C. D. may be seen from the following illustration:—

1. 30 equals 5×6.
2. 48 equals 8×6.

Adding, 3. 78 equals $(8+5) \times 6$, or 13×6.

That is, the sum of two numbers contains their common divisor, without a remainder.

1. 48 equals 8×6.
2. 30 equals 5×6.

Subtracting, 3. 18 equals $(8-5) \times 6$, or 3×6.

That is, the difference between two numbers contains their common divisor, without a remainder.

From this illustration are derived the principles:—

1. A common divisor of two or more numbers is also a divisor of their sum.

2. A common divisor of two numbers is also a divisor of their difference.

From the definitions and solutions of the L. C. M. it is seen that the solutions are based on the following principles:—

1. A multiple of a number contains each of the prime factors of that number.

2. A common multiple of two or more numbers contains each of the prime factors of these numbers.

3. The L. C. M. of two or more numbers contains each of the prime factors of these numbers, and no others.

4. The L. C. M. of numbers prime to each other is their product.

CANCELLATION is a process by which division is shortened by omitting or canceling common factors. It depends upon the principle that dividing both divisor and dividend by the same factor does not change the quotient.

1. Divide the product of 72 and 25 by 45.

SOLUTION.

$\frac{72\times25}{45}=\frac{8\times\cancel{9}\times\cancel{5}\times5}{\cancel{9}\times\cancel{5}}=40$

Find the factors of the several numbers of the dividend, and also of the divisor. Cancel the common factors, and find the product of those remaining.

2. Divide, by cancellation, $12\times14\times16$ by $6\times7\times8$.
3. Divide, by cancellation, $20\times32\times35$ by $4\times5\times16$.
4. Divide, by cancellation, 180×270 by 45×108.
5. Divide, by cancellation, 125×250 by 50×75.
6. Divide, by cancellation, 120×140 by 60×350.
7. Divide, by cancellation, $45\times49\times81$ by $35\times84\times63$.
8. Divide, by cancellation, $60\times77\times32$ by $25\times42\times33$.
9. Divide, by cancellation, $75\times42\times99$ by $33\times63\times125$.
10. Divide, by cancellation, 200×2600 by 200×200.
11. Divide, by cancellation, 300×2700 by 300×300.
12. Divide, by cancellation, 300×3200 by 300×400.
13. Divide, by cancellation, 400×3200 by 400×800.
14. How many tons of hay at \$12 a ton will pay for 4 cows at \$21 each?
15. How many bushels of potatoes at 45 cents a bushel will pay for 125 pounds of butter at 18 cents a pound?
16. How many days required for 300 men to do a piece of work that 100 men can do in 12 days?
17. How much will 56 yd. of cloth cost if 24 yd. cost \$120?
18. Write the rule for the process of cancellation.

DEFINITIONS.

A UNIT is any standard used in counting or measuring. If a man says he walked 5 miles, the unit of distance by which he expresses how far he traveled is 1 *mile*. If a farmer says his field produced one thousand bushels of grain, the unit by which he expresses the quantity is 1 *bushel*. If a landlord wishes to tell how much land he owns, he uses 1 *acre* as a unit. In expressing abstract numbers, 1 is the unit.

When the number or quantity to be expressed is less than a unit or standard of measurement, it is expressed as a part or parts of the unit.

A FRACTION expresses one or more of the equal parts of a unit or standard of measurement.

A COMMON FRACTION is expressed by two numbers, one above the line, with a line between them; thus, $\frac{3}{4}$.

THE DENOMINATOR of a fraction is the number below the line, and shows into how many equal parts the unit is divided.

THE NUMERATOR of a fraction is the number above the line, and shows how many of the equal parts are taken.

THE TERMS of a fraction are its numerator and denominator; thus, 3 and 4 are the terms of the fraction $\frac{3}{4}$.

To distinguish them from fractions, whole numbers are called INTEGERS, or INTEGRAL NUMBERS.

AN INTEGER may be expressed in a fractional form by writing 1 under it for a denominator; thus, $\frac{4}{1}=4$.

A PROPER FRACTION is one whose numerator is less than the denominator; as, $\frac{3}{4}$.

AN IMPROPER FRACTION is one whose numerator equals or exceeds its denominator; as, $\frac{4}{4}$, $\frac{5}{3}$. An improper fraction equals or exceeds a unit; hence its name, *improper fraction*.

A MIXED NUMBER is an integer and a fraction united; as, $4\frac{2}{3}$.

1. Change $12\frac{3}{5}$ to an improper fraction.

SOLUTION.

$1 = \frac{5}{5}$

$12 = 12 \times \frac{5}{5} = \frac{60}{5}$

$\frac{60}{5} + \frac{3}{5} = \frac{63}{5}$

In 1 are 5 fifths; in 12 there are 12 times 5 fifths, or 60 fifths; to this add the 3 fifths, which gives 63 fifths as the value of the mixed number.

2. $21\frac{1}{6} = ?$
3. $35\frac{5}{7} = ?$
4. $17\frac{3}{8} = ?$
5. $36\frac{4}{9} = ?$
6. $50\frac{9}{11} = ?$
7. $24\frac{3}{7} = ?$
8. $24\frac{7}{12} = ?$
9. $19\frac{7}{9} = ?$
10. $37\frac{9}{11} = ?$
11. $48\frac{5}{6} = ?$
12. $13\frac{9}{13} = ?$
13. $17\frac{5}{8} = ?$
14. $78\frac{5}{9} = ?$
15. $49\frac{11}{12} = ?$
16. $67\frac{7}{9} = ?$

17. How many yards in $\frac{75}{4}$ of a yard?

SOLUTION.

$4)\underline{75}$

$18\frac{3}{4}$ yards.

Since there are 4 fourths in 1 yard, there are as many yards as 4 fourths are contained times in 75 fourths, or $18\frac{3}{4}$ yards.

Change to whole or mixed numbers—

18. $\frac{171}{12}$
19. $\frac{775}{25}$
20. $\frac{124}{9}$
21. $\frac{726}{11}$
22. $\frac{178}{63}$
23. $\frac{432}{10}$
24. $\frac{403}{13}$
25. $\frac{936}{30}$
26. $\frac{425}{17}$
27. $\frac{785}{37}$
28. $\frac{260}{11}$
29. $\frac{133}{19}$
30. $\frac{401}{13}$
31. $\frac{111}{17}$
32. $\frac{576}{24}$

33. How may any integer be expressed in fractional form?

34. Write the rule for changing a whole or mixed number to an improper fraction.

35. Write the rule for changing an improper fraction to a whole or mixed number.

A fraction is sometimes thought of as an indicated division. If \$3 are divided among 5 boys, the amount each boy would receive is found by dividing \$3 by 5, which is written $\$\frac{3}{5}$. The fraction thus indicates a division to be performed, in which —

The numerator is the dividend,
The denominator is the divisor,
The fraction itself is the quotient.

It follows that if the terms of a fraction are changed by multiplication or division, the value of the fraction changes according to the principles given on page 114. If a like change is made in both terms of the fraction, the value is not changed.

1. Change $\frac{3}{4}$ to twelfths.

SOLUTION.

$\frac{3\times3=9}{4\times3=12}$ To change the denominator to 12, it must be multiplied by 3. To preserve the same value of the fraction, the numerator must also be multiplied by 3.

2. Change $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$ to 24ths.
3. Change $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, and $\frac{1}{9}$ to 18ths.
4. Change $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$, and $\frac{1}{7}$ to 42ds.
5. Change $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{5}$, and $\frac{1}{6}$ to 30ths.
6. Change $\frac{1}{5}$, $\frac{1}{8}$, $\frac{1}{16}$, and $\frac{1}{20}$ to 80ths.
7. Change $\frac{1}{4}$, $\frac{1}{7}$, $\frac{1}{8}$, and $\frac{1}{14}$ to 56ths.

Reduce to the least common denominator * —

8. $\frac{3}{8}$, $\frac{4}{7}$, and $\frac{5}{12}$.
9. $\frac{3}{7}$, $\frac{5}{14}$, and $\frac{16}{21}$.
10. $\frac{8}{11}$, $\frac{3}{22}$, and $\frac{5}{33}$.
11. $\frac{1}{2}$, $\frac{1}{14}$, and $\frac{5}{21}$.

*The L. C. M. of the given denominators. See page 131.

A fraction is in its *lowest terms* when its terms are the smallest integers which will express its value. A fraction may be changed to its lowest terms by dividing both numerator and denominator by all their common factors, or by their greatest common divisor. The terms will then be prime to each other.

1. Change $\frac{24}{36}$ to its lowest terms.

SOLUTION.

Dividing both terms by 12, their G. C. D., gives $\frac{2}{3}$ for a result; or dividing first by 3, and the resulting terms by 4, will give the same final result, $\frac{2}{3}$.

Reduce to lowest terms —

2. $\frac{15}{18}$
3. $\frac{30}{40}$
4. $\frac{54}{56}$
5. $\frac{48}{72}$
6. $\frac{49}{91}$
7. $\frac{42}{90}$
8. $\frac{52}{65}$
9. $\frac{108}{120}$
10. $\frac{84}{228}$
11. $\frac{15}{175}$
12. $\frac{132}{180}$
13. $\frac{138}{150}$
14. $\frac{96}{144}$
15. $\frac{39}{273}$
16. $\frac{363}{605}$
17. $\frac{323}{391}$
18. $\frac{931}{969}$
19. $\frac{299}{713}$
20. $\frac{374}{561}$
21. $\frac{1628}{2244}$
22. $\frac{1261}{1649}$

23. What is shown by the numerator of a fraction?

24. What is shown by the denominator of a fraction?

25. How may the terms of a fraction be changed without changing its value?

26. What is the least common denominator of two or more fractions?

27. Write the rule for changing fractions to the least common denominator.

28. Give two methods for reducing fractions to their lowest terms.

Numbers may be compared and their relations expressed by stating what fractional part one number is of another.

1. What part of 7 is 3?

SOLUTION. — 1 is $\frac{1}{7}$ of 7; 3 is $3 \times \frac{1}{7}$, or $\frac{3}{7}$ of 7.

What fractional part —

2. Of 12 is 6?
3. Of 16 is 8?
4. Of 18 is 6?
5. Of 30 is 9?
6. Is 12 of 18?
7. Is 18 of 24?
8. Of 25 is 20?
9. Of 24 is 21?
10. Of 27 is 20?
11. Of 20 is 18?
12. Is 20 of 32?
13. Of 21 is 14?
14. Is 15 of 25?
15. Is 24 of 25?
16. Of 30 is 25?
17. Is 8 of 20?
18. Of 27 is 20?
19. Is 8 of 32?
20. Is 12 of 16?
21. Of 28 is 27?
22. Is 33 of 44?

23. What part of 5 is $\frac{2}{3}$?

SOLUTION. — 1 is $\frac{1}{5}$ of 5; $\frac{2}{3}$ is $\frac{2}{3}$ of $\frac{1}{5}$, or $\frac{2}{15}$ of 5.

What fractional part —

24. Of 5 is $\frac{3}{5}$?
25. Of 6 is $\frac{5}{6}$?
26. Of 7 is $\frac{3}{5}$?
27. Of 8 is $\frac{2}{3}$?
28. Of 7 is $\frac{2}{3}$?
29. Of 9 is $\frac{4}{5}$?
30. Of 8 is $\frac{3}{4}$?
31. Of 10 is $\frac{7}{8}$?
32. Of 8 is $\frac{3}{8}$?
33. Of 11 is $\frac{4}{7}$?
34. Of 10 is $\frac{3}{7}$?
35. Of 12 is $\frac{8}{9}$?

36. 24 is $\frac{3}{4}$ of what number?

SOLUTION.

$\frac{3}{4}$ of the number $= 24$.
$\frac{1}{4}$ of the number $= \frac{1}{3}$ of 24, or 8.
$\frac{4}{4}$, or the number $= 4 \times 8$, or 32.

37. 25 is $\frac{5}{7}$ of what?
38. 64 is $\frac{8}{9}$ of what?
39. 125 is $\frac{5}{6}$ of what?
40. 321 is $\frac{3}{4}$ of what?

1. Reduce .75 to the form of a common fraction.

SOLUTION.

$.75=\frac{75}{100}$ Write the proper denominator as in a common
$\frac{75}{100}=\frac{3}{4}$ fraction and reduce to lowest terms.

Reduce to common fractions in their lowest terms—

2. .8	**9.** .225	**16.** .1275
3. .12	**10.** .05	**17.** .0875
4. .15	**11.** .025	**18.** .005
5. .25	**12.** .325	**19.** .0025
6. .35	**13.** .875	**20.** .0075
7. .48	**14.** .4375	**21.** .9375
8. .125	**15.** .3125	**22.** .0625

23. Change $\frac{3}{4}$ to a decimal.

SOLUTION.

4)3.00 Since a fraction is an indicate division, the divis-
.75 ion, may be performed by annexing ciphers to the numerator and dividing as in decimals.

24. $\frac{3}{5}=$___	**30.** $\frac{5}{16}=$___	**36.** $\frac{15}{16}=$___
25. $\frac{1}{8}=$___	**31.** $\frac{1}{20}=$___	**37.** $\frac{9}{40}=$___
26. $\frac{8}{8}=$___	**32.** $\frac{12}{20}=$___	**38.** $\frac{7}{400}=$___
27. $\frac{5}{8}=$___	**33.** $\frac{7}{14}=$___	**39.** $\frac{1}{32}=$___
28. $\frac{7}{8}=$___	**34.** $\frac{7}{140}=$___	**40.** $\frac{3}{64}=$___
29. $\frac{3}{16}=$___	**35.** $\frac{4}{25}=$___	**41.** $\frac{3}{800}=$___

42. Write the rule for changing a common fraction to a decimal.

43. Write the rule for changing a decimal to a common fraction.

44. Write the definition of a unit.

45. Write the definition of a fraction.

Fractions may be added or subtracted if they express similar fractional units. They must, therefore, be reduced to a common denominator.

1. Find the sum of $\frac{1}{5}$ and $\frac{1}{7}$.

SOLUTION.

$\frac{1}{5} = \frac{7}{35}$
$\frac{1}{7} = \frac{5}{35}$
$\frac{7}{35} + \frac{5}{35} = \frac{12}{35}$

Unlike numbers cannot be added. The fractions must be changed to a common denominator. They are then added as any other like numbers.

Find the sum of —

2. $\frac{1}{2}$ and $\frac{5}{6}$.	**6.** $\frac{2}{3}$ and $\frac{7}{8}$.	**10.** $\frac{2}{3}$ and $\frac{5}{7}$.
3. $\frac{1}{2}$ and $\frac{7}{10}$.	**7.** $\frac{3}{4}$ and $\frac{5}{6}$.	**11.** $\frac{2}{5}$ and $\frac{5}{8}$.
4. $\frac{1}{2}$ and $\frac{1}{11}$.	**8.** $\frac{3}{4}$ and $\frac{5}{7}$.	**12.** $\frac{2}{5}$ and $\frac{5}{9}$.
5. $\frac{2}{3}$ and $\frac{4}{5}$.	**9.** $\frac{3}{4}$ and $\frac{2}{9}$.	**13.** $\frac{5}{6}$ and $\frac{4}{7}$.

14. Find the difference between $\frac{2}{3}$ and $\frac{2}{5}$.

SOLUTION.

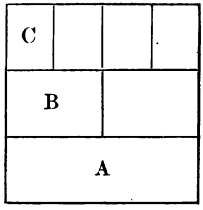
$\frac{2}{3} = \frac{10}{15}$
$\frac{3}{5} = \frac{9}{15}$
$\frac{10}{15} - \frac{9}{15} = \frac{1}{15}$

Only like numbers can be subtracted. The fractions must be reduced to a common denominator. The difference between their numerators can then be found.

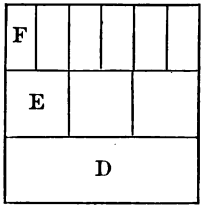
Find the difference between —

15. $\frac{3}{4}$ and $\frac{2}{5}$.	**18.** $\frac{8}{9}$ and $\frac{9}{11}$.	**21.** $4\frac{1}{4}$ and $3\frac{1}{3}$.
16. $\frac{4}{5}$ and $\frac{5}{7}$.	**19.** $\frac{8}{11}$ and $\frac{11}{12}$.	**22.** $5\frac{1}{2}$ and $4\frac{1}{5}$.
17. $\frac{3}{4}$ and $\frac{8}{9}$.	**20.** $2\frac{1}{2}$ and $1\frac{1}{3}$.	**23.** $4\frac{1}{5}$ and $3\frac{1}{6}$.

24. Write the rule for reducing to a common denominator.
25. Write the rule for addition of fractions.
26. Write the rule for subtraction of fractions.



One Square Inch.



One Square Inch.

1. What part of a square inch is A? Is B? Is C?
2. What part of a square inch is D? Is E? Is F?
3. What part of a square inch is B+C? Is A+B?
4. What part of a square inch is A+C? Is A+B+C?
5. What part of a square inch is D? Is E? Is F?
6. What part of a square inch is D+E? Is D+F?
7. What part of a square inch is E+F? Is D+E+F?
8. What part of A is B? Is C? Is B+C?
9. What part of D is E? Is F? Is E+F?
10. What part of B is C? Is F? Is E? Is E+F?
11. What part of E is C? Of C is F? Of A is B+F?
12. What part of B+C is C? Of D+E is E?
13. What part of 3 times B is 3 times E?
14. What part of 3 times E is 3 times C?
15. What part of 3 times C is 3 times F?
16. What part of 4 times B is 4 times E?
17. What part of 4 times E is 4 times C?
18. What part of 4 times C is 4 times F?
19. What part of 2 times D is 3 times B?
20. What part of 4 times E is 2 times B?
21. What part of 4 times C is 2 times E?
22. What part of A+B is D+E? Of D—E is A—B?
23. What part of B+C is E+F? Of B—C is E—F?
24. What part of B+F is F? Of B+F is E?
25. What part of B+E is F? Of B+E is E?

1. Count by $\frac{2}{8}$ from $\frac{2}{8}$ to 8, and back from 8 to $\frac{2}{8}$.
2. Count by $\frac{3}{4}$ from $\frac{3}{4}$ to 9, and back from 9 to $\frac{3}{4}$.
3. Count by $\frac{3}{5}$ from $\frac{3}{5}$ to 6, and back from 6 to $\frac{3}{5}$.
4. Count by $\frac{4}{5}$ from $\frac{4}{5}$ to 8, and back from 8 to $\frac{4}{5}$.
5. Count by $\frac{5}{6}$ from $\frac{5}{6}$ to 10, and back from 10 to $\frac{5}{6}$.
6. Count by $\frac{4}{7}$ from $\frac{4}{7}$ to 8, and back from 8 to $\frac{4}{7}$.
7. Count by $\frac{5}{8}$ from $\frac{5}{8}$ to 5, and back from 5 to $\frac{5}{8}$.
8. Count by $\frac{5}{9}$ from $\frac{5}{9}$ to 5, and back from 5 to $\frac{5}{9}$.

9. Find 4 times $\frac{3}{16}$.

SOLUTION I.

$\frac{4}{1}\times\frac{3}{16}=\frac{3}{4}$. Regarding the fraction as an indicated division, write the 4 in the form of a fraction, and use cancellation. This gives $\frac{3}{4}$ for a product.

SOLUTION II.

Regarding the fraction as a concrete number, 4 times 3 *sixteenths* are 12 *sixteenths*, written $\frac{12}{16}$, found by multiplying the numerator of the fraction. Reduce to lowest terms.

10. $10\times\frac{4}{15}$
11. $6\times\frac{8}{15}$
12. $7\times\frac{4}{21}$
13. $14\times\frac{5}{7}$
14. $36\times\frac{7}{9}$
15. $45\times\frac{7}{9}$
16. $9\times\frac{5}{6}$
17. $72\times\frac{5}{9}$
18. $30\times\frac{40}{90}$
19. $15\times\frac{24}{40}$
20. $\frac{35}{72}\times 36$*
21. $\frac{3}{10}\times 21$
22. $\frac{27}{25}\times 14$
23. $\frac{7}{9}\times 108$
24. $\frac{13}{30}\times 120$
25. $\frac{12}{65}\times 65$
26. $\frac{18}{19}\times 76$
27. $\frac{7}{9}\times 117$
28. $\frac{8}{9}\times 199$
29. $\frac{5}{21}\times 84$
30. $12\frac{1}{2}\times 9$†
31. $24\times 6\frac{5}{8}$
32. $42\times 9\frac{3}{7}$
33. $25\times 8\frac{3}{5}$
34. $48\times 6\frac{1}{4}$
35. $72\times 7\frac{7}{8}$
36. $66\times 2\frac{3}{11}$
37. $86\times 6\frac{1}{6}$
38. $50\times 37\frac{9}{10}$
39. $99\times 5\frac{5}{11}$

* Either the integer or fraction may be the multiplier.

† Multiply the integer and fraction separately and add.

1. Multiply $\frac{3}{4}$ by $\frac{5}{6}$.

SOLUTION.

$\frac{3}{4}\times 5=\frac{15}{4}$

$\frac{1}{6}$ of $\frac{15}{4}=\frac{15}{24}=\frac{5}{8}$

$\frac{\cancel{3}}{\cancel{4}}\times\frac{\cancel{5}}{\cancel{6}_2}=\frac{5}{8}$

Multiplying $\frac{3}{4}$ by 5 gives $\frac{15}{4}$ for a product. But the multiplier is $\frac{5}{6}$, or $\frac{1}{6}$ of 5. The product is therefore 6 times the required product. To find $\frac{1}{6}$ of $\frac{15}{4}$, the numerator, which expresses the number of parts, must be divided by 6, or the size of each part expressed by the denominator must be made smaller by multiplying the denominator by 6. The work is simplified by using cancellation.

Find the product of—

2. $\frac{8}{9}$ and $\frac{5}{7}$.*
3. $\frac{4}{5}$ and $\frac{6}{7}$.
4. $\frac{5}{6}$ and $\frac{3}{5}$.
5. $\frac{6}{7}$ and $\frac{9}{10}$.
6. $\frac{7}{8}$ and $\frac{11}{12}$.
7. $\frac{11}{12}$ and $\frac{16}{22}$.
8. $\frac{3}{5}$ and $\frac{4}{9}$.
9. $\frac{2}{3}$ and $\frac{9}{16}$.
10. $\frac{5}{6}$ and $\frac{7}{8}$.
11. $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{4}{5}$.
12. $\frac{3}{5}$, $\frac{4}{7}$, and $\frac{10}{12}$.
13. $\frac{5}{6}$, $\frac{7}{8}$, and $\frac{24}{35}$.
14. $\frac{4}{5}$, $\frac{6}{7}$, and $\frac{21}{28}$.
15. $\frac{2}{3}$, $4\frac{1}{2}$, and $1\frac{1}{8}$.†
16. $\frac{4}{5}$, $\frac{3}{8}$, and $3\frac{1}{3}$.
17. $\frac{7}{8}$, $\frac{2}{3}$, and $\frac{5}{6}$.
18. $\frac{4}{9}$, $\frac{10}{11}$, and $\frac{8}{15}$.
19. $\frac{7}{8}$, $\frac{5}{9}$, and $5\frac{1}{6}$.

20. $\frac{8}{9}\times\frac{3}{4}=?$
21. $\frac{7}{9}\times 3\frac{3}{5}=?$
22. $4\frac{2}{3}\times 5\frac{1}{7}=?$
23. $6\frac{2}{7}\times 4\frac{3}{8}=?$
24. $3\frac{1}{5}\times\frac{11}{12}\times\frac{2}{3}=?$
25. $4\frac{1}{5}\times 3\frac{2}{3}\times 7\frac{1}{2}=?$
26. $\frac{6}{7}\times\frac{5}{9}\times\frac{3}{4}\times\frac{7}{8}=?$
27. $2\frac{2}{5}\times\frac{5}{6}\times 4\frac{1}{2}\times\frac{3}{8}=?$
28. $4\frac{1}{2}\times 6\frac{2}{3}\times 1\frac{1}{5}\times\frac{2}{3}=?$
29. $1\frac{1}{2}\times 1\frac{1}{4}\times 1\frac{1}{5}\times\frac{3}{4}=?$

* If there are no common factors for cancellation, multiply the numerator for a new numerator, and the denominator for a new denominator.

† Reduce mixed numbers to improper fractions before multiplying.

1. Divide $\frac{8}{9}$ by 2.

SOLUTION.

8 *ninths* divided by 2 equals 4 *ninths*, expressed by $\frac{4}{9}$. Also, $\frac{1}{2}$ of $\frac{8}{9}$, written $\frac{1}{2}\times\frac{8}{9}$, becomes a problem in multiplication of fractions. Notice that to divide the numerator by 2, one half the *number* of fractional units is found, the size of the fractional unit remaining the same; while to multiply the denominator by 2, the number of parts remains the same, but the *size* of the fractional unit is one half as large as before. The results are equivalent ($\frac{8}{18}=\frac{4}{9}$).

2. Divide 4 by $\frac{2}{3}$.

SOLUTION.

$4\div 2=2$. But the divisor is $\frac{2}{3}$, or $\frac{1}{3}$ of 2, and the quotient must be 3 times 2, or 6. The process is equivalent to inverting the divisor and multiplying.

3. Divide $\frac{3}{4}$ by $\frac{5}{6}$.

SOLUTION.

Consider the divisor, $\frac{5}{6}$, as $\frac{1}{6}$ of 5. Dividing $\frac{3}{4}$ by 5 gives $\frac{3}{20}$ for a quotient. But the true divisor is $\frac{1}{6}$ of 5, which will give a quotient 6 times as large as $\frac{3}{20}$, or $\frac{18}{20}$, which reduced to lowest terms is $\frac{9}{10}$. This process, as in the previous example, inverts the divisor and multiplies. Thus, $\frac{3}{4}\div\frac{5}{6}$ equals $\frac{3}{4}\times\frac{6}{5}$, or $\frac{9}{10}$. *Use cancellation.*

4. What is the cost of a ton of hay, if 4 tons cost \$45?
5. What is the cost of a ton of hay, if $\frac{2}{3}$ ton cost \$ 8?
6. What is the cost of a ton of hay, if $\frac{5}{6}$ ton cost \$10?
7. What is the cost of a ton of hay, if $\frac{3}{4}$ ton cost \$10?
8. What is the cost of a ton of hay, if $1\frac{1}{3}$ tons cost \$16?
9. What is the cost of a ton of hay, if $3\frac{1}{2}$ tons cost \$36?

A COMPOUND FRACTION is a fraction of a fraction, or two or more fractions connected by the word *of;* as, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{4}{5}$.

The *reciprocal* of a number is 1 divided by that number. The reciprocal of 4 is $\frac{1}{4}$; of $\frac{1}{4}$ is 4. The reciprocal of a fraction is the fraction inverted.

A fraction is *inverted* by causing the terms to change places. Thus, $\frac{2}{4}$ inverted becomes $\frac{4}{3}$. One explanation for inverting the divisor in division of fractions is to show *how often the divisor is contained in 1.*

1. What is the quotient of $\frac{4}{7}$ divided by $\frac{5}{9}$?

SOLUTION.—$\frac{4}{7} \div \frac{5}{9} = \frac{4}{7} \times \frac{9}{5} = \frac{36}{35}$, or $1\frac{1}{35}$.

2. $\frac{5}{6} \div \frac{1}{18} = ?$
3. $\frac{4}{5} \div \frac{1}{15} = ?$
4. $\frac{5}{6} \div \frac{1}{9} = ?$
5. $\frac{3}{8} \div \frac{5}{6} = ?$
6. $\frac{2}{7} \div \frac{4}{9} = ?$
7. $\frac{5}{6} \div 1\frac{1}{12} = ?$
8. $\frac{1}{2} \div \frac{2}{3} = ?$
9. $\frac{4}{5} \div \frac{1}{25} = ?$
10. $\frac{5}{7} \div \frac{1}{28} = ?$
11. $\frac{4}{5} \div \frac{2}{25} = ?$
12. $\frac{2}{3} \div \frac{3}{5} = ?$
13. $\frac{8}{21} \div \frac{4}{63} = ?$
14. $\frac{1}{38} \div \frac{7}{57} = ?$
15. $\frac{1}{8} \div \frac{1}{24} = ?$
16. $\frac{7}{8} \div 1\frac{4}{15} = ?$
17. $\frac{7}{9} \div 1\frac{1}{12} = ?$
18. $1\frac{2}{3} \div 2\frac{1}{7} = ?$
19. $4\frac{1}{2} \div 5\frac{1}{4} = ?$
20. $3\frac{3}{4} \div 1\frac{7}{8} = ?$
21. $2\frac{2}{3} \div 3\frac{1}{5} = ?$
22. $5\frac{3}{5} \div 2\frac{5}{8} = ?$
23. $8\frac{1}{3} \div 2\frac{6}{7} = ?$
24. $5\frac{5}{6} \div 1\frac{1}{6} = ?$
25. $6\frac{3}{5} \div 8\frac{5}{8} = ?$
26. $4\frac{1}{8} \div 9\frac{3}{7} = ?$
27. $21\frac{7}{18} \div 2\frac{5}{24} = ?$
28. $9\frac{3}{7} \div 4\frac{1}{8} = ?$
29. $8\frac{5}{8} \div 6\frac{3}{5} = ?$
30. $5\frac{1}{4} \div 4\frac{1}{2} = ?$
31. $2\frac{1}{7} \div 3\frac{1}{8} = ?$
32. $6\frac{2}{5} \div 2\frac{2}{8} = ?$
33. $5\frac{1}{4} + 5\frac{3}{5} = ?$
34. $8\frac{4}{7} \div 8\frac{1}{8} = ?$

35. $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{7}{8} \div \frac{5}{6}$ of $\frac{7}{5}$ of $\frac{9}{10} = ?$
36. $\frac{2}{3}$ of $\frac{4}{9}$ of $\frac{6}{8} \div \frac{5}{7}$ of $\frac{6}{9}$ of $\frac{24}{25} = ?$
37. $\frac{8}{9}$ of $\frac{7}{8}$ of $\frac{5}{6} \div \frac{10}{11}$ of $\frac{8}{15}$ of $\frac{21}{30} = ?$
38. $\frac{1}{9}$ of $\frac{6}{7}$ of $4\frac{2}{3} \div 2\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{10}{12} = ?$
39. $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ are how many times $\frac{3}{8}$?
40. $\frac{3}{5}$ of $\frac{7}{9} \div 2\frac{4}{5}$ are how many times 6?
41. $\frac{5}{8}$ of $\frac{6}{7} \div 1\frac{5}{16}$ are how many times $\frac{4}{21}$?

QUANTITY, in business transactions, is the amount of anything considered, or of any commodity bought or sold.

PRICE is the value in money of *one*, or of a *given unit* of any commodity.

COST is the value in money of the *entire quantity* bought or sold.

AN ALIQUOT PART of a number is an exact divisor of that number; or, it is *one* of the *equal parts* of the number.

When comparisons are made with 100, the operation is called *percentage*, and the part is called a certain *per cent* of the whole.

PER CENT means *by the hundred.* The whole of a number is called 100 per cent of that number. And just as $\frac{1}{2}$ of a dollar is 50 cents, so $\frac{1}{2}$ of any number is 50 per cent of that number.

Per cent is indicated by the sign, %. This is but another method of expressing *hundredths*, which may be expressed by a *decimal*, a *common fraction*, or by the term *per cent*, indicated by the sign, %. Pupils will understand the application of percentage when they note that their standing in their class is indicated by 80%, 90%, etc., when a perfect record is indicated by 100. Often the given *per cent* or *decimal* may be changed to a common fraction, and the work becomes easier and shorter.

This is of special value in business transactions involving the use of aliquot parts of a dollar, as shown by the table and problems on the next page.

Distinguish between *number* and *quantity*.
Distinguish between *price* and *cost*.
Distinguish between *per cent* and *decimal*.
Distinguish between *decimal* and *common* fractions.

TABLE.

50% of a dollar	$=\frac{1}{2}=\$.50$.	$83\frac{1}{3}\%$ of a dollar	$=\frac{5}{6}=\$.83\frac{1}{3}$.
$33\frac{1}{3}\%$ of a dollar	$=\frac{1}{3}=\$.33\frac{1}{3}$.	$12\frac{1}{2}\%$ of a dollar	$=\frac{1}{8}=\$.12\frac{1}{2}$.
$66\frac{2}{3}\%$ of a dollar	$=\frac{2}{3}=\$.66\frac{2}{3}$.	$37\frac{1}{2}\%$ of a dollar	$=\frac{3}{8}=\$.37\frac{1}{2}$.
25% of a dollar	$=\frac{1}{4}=\$.25$.	$62\frac{1}{2}\%$ of a dollar	$=\frac{5}{8}=\$.62\frac{1}{2}$.
75% of a dollar	$=\frac{3}{4}=\$.75$.	$87\frac{1}{2}\%$ of a dollar	$=\frac{7}{8}=\$.87\frac{1}{2}$.
20% of a dollar	$=\frac{1}{5}=\$.20$.	$8\frac{1}{3}\%$ of a dollar	$=\frac{1}{12}=\$.08\frac{1}{3}$.
40% of a dollar	$=\frac{2}{5}=\$.40$.	$41\frac{2}{3}\%$ of a dollar	$=\frac{5}{12}=\$.41\frac{2}{3}$.
60% of a dollar	$=\frac{3}{5}=\$.60$.	$58\frac{1}{3}\%$ of a dollar	$=\frac{7}{12}=\$.58\frac{1}{3}$.
80% of a dollar	$=\frac{4}{5}=\$.80$.	$6\frac{1}{4}\%$ of a dollar	$=\frac{1}{16}=\$.06\frac{1}{4}$.
$16\frac{2}{3}\%$ of a dollar	$=\frac{1}{6}=\$.16\frac{2}{3}$.	$18\frac{3}{4}\%$ of a dollar	$=\frac{3}{16}=\$.18\frac{3}{4}$.

Find the cost—

1. Of 50% of 48 yards of goods at $12\frac{1}{2}$ cent, per yard.

SOLUTION.

50% of 48 yards $=\frac{1}{2}$ of 48 yards, or 24 yards.
1 yard cost $12\frac{1}{2}$ cents, or $\$\frac{1}{8}$.
24 yards cost 24 times $\$\frac{1}{8}=\$\frac{24}{8}$, or \$3.00.

2. Of 50% of 50 yards of cloth at 50¢ per yard.
3. Of 40% of 60 bushels of grain at $33\frac{1}{3}$¢ per bushel.
4. Of $33\frac{1}{3}\%$ of 144 bushels of grain at $33\frac{1}{3}$¢ per bushel.
5. Of 25% of 700 pounds of grain at \$1.25 per cental.
6. Of 20% of 120 pounds of coffee at $37\frac{1}{2}$¢ per pound.
7. Of $16\frac{2}{3}\%$ of 42 pounds of coffee at $37\frac{1}{2}$¢ per pound.
8. Of $12\frac{1}{2}\%$ of 160 acres at \$2.50 an acre.
9. Of 5 % of 1,200 bushels at $37\frac{1}{2}$¢ per bushel.
10. Of $6\frac{1}{4}\%$ of 4,800 bushels at 50¢ per bushel.
11. Of $8\frac{1}{3}\%$ of 4,800 bushels at 75¢ per bushel.
12. Of $37\frac{1}{2}\%$ of 2,400 bushels at 40¢ per bushel.
13. Of $66\frac{2}{3}\%$ of 3,000 bushels at 25¢ per bushel.
14. Of $18\frac{3}{4}\%$ of 4,800 bushels at 65¢ per bushel.

Find the cost—

1. Of 916 pair of shoes at $1.75 a pair.

SOLUTION.

The cost at $1.00 a pair, $916.00.
The cost at $ .50 a pair, 458.00.
The cost at $ .25 a pair, 229.00.
The cost at $1.75 a pair, $1603.00.

2. Of 140 centals of grain at $1.25 per cental.
3. Of 84 yards of cloth at $1.66⅔ per yard.
4. Of 6 dozen pair of boots at $2.87½ per pair.
5. Of 960 yards of carpet at $1.12½ per yard.
6. Of 960 yards of carpet at $1.37½ per yard.
7. Of 960 yards of carpet at $1.87½ per yard.
8. Of 32 boys' suits at $12.75 each.
9. Of 1,875 feet lumber at $10.50 per M.
10. Of 15,500 shingles at $5.75 per M.
11. Of 24 dozen knives at $5.37½ per dozen.
12. Of 750 envelopes at $1.66⅔ a hundred.
13. Of 6 dozen pair shoes at $1.62½ a pair.
14. Of 1,250 feet of lumber at $16 per M.
15. Of 2,500 pounds of grain at $16 per ton.
16. Of 60 hats at $1.75 each.
17. Of 16 yards of carpet at $1.75 per yard.
18. Of 60 tons of coal at $3.75 per ton.
19. Of 80 tons of coal at $3.62½ per ton.
20. Of 155 yards of silk at $1.60 per yard.
21. Of 1,200 bushels of grain at $1.12½ per bushel.
22. Of 160 acres of land at $10.75 per acre.
23. Of 800 pounds of grain at $1.87½ per cental.
24. Of 200 barrels of apples at $3.15 per barrel.
25. Of 120 pounds of tea at $1.62½ per pound.

1. At \$10 per ton, find the cost of 5600 pounds of hay.

SOLUTION.

2000 lb. cost	\$10.00
2000 lb. cost	10.00
1000 lb. cost	5.00
500 lb. cost	2.50
100 lb. cost	.50
5600 lb. cost	\$28.00

2. At \$16.00 per ton, find the cost of 3250 pounds of hay.
3. At \$12.00 per ton, find the cost of 3600 pounds of hay.
4. At \$ 6.00 per ton, find the cost of 2300 pounds of hay.
5. At \$ 8.00 per ton, find the cost of 2700 pounds of hay.
6. At \$ 8.00 per ton, find the cost of 3300 pounds of hay.
7. At \$ 8.00 per ton, find the cost of 4400 pounds of hay.
8. At \$16.00 per ton, find the cost of 2600 pounds of hay.
9. At \$16.00 per ton, find the cost of 3600 pounds of hay.
10. At \$16.00 per ton, find the cost of 4600 pounds of hay.
11. At \$ 5.00 per ton, find the cost of 4370 pounds of coal.
12. At \$ 5.00 per ton, find the cost of 3260 pounds of coal.
13. At \$ 4.50 per ton, find the cost of 3600 pounds of coal.
14. At \$ 4.50 per ton, find the cost of 3330 pounds of coal.
15. At \$ 4.50 per ton, find the cost of 5440 pounds of coal.
16. At \$ 3.25 per ton, find the cost of 4550 pounds of coal.
17. At \$ 4.50 per ton, find the cost of 8135 pounds of coal.
18. At \$18.50 per ton, find the cost of 3750 pounds of coal.
19. At \$ 3.50 per ton, find the cost of 8175 pounds of coal.
20. At \$17.00 per hundred, find the cost of 575 melons.
21. At \$ 2.40 per hundred, find the cost of 1275 bananas.
22. At \$44.00 per thousand, find the cost of 5650 feet of lumber.
23. At \$21.00 per thousand, find the cost of 2250 feet of lumber.

Find the cost—

1. Of $16\frac{3}{4}$ yards of carpet at \$1.20 per yard.
2. Of $32\frac{5}{8}$ cords of wood at \$4.00 per cord.
3. Of $6\frac{1}{2}$ tons coal at \$3.50 per ton.
4. Of $30\frac{1}{3}$ feet wire at $2\frac{1}{4}$ cents per foot.
5. Of $32\frac{3}{4}$ bushels potatoes at $33\frac{1}{3}$ cents per bushel.
6. Of 175 barrels apples at $\$3\frac{1}{5}$ per barrel.
7. Of $22\frac{1}{2}$ pounds cheese at $9\frac{3}{4}$ cents per pound.
8. Of 150 yards muslin at $15\frac{3}{4}$ cents per yard.
9. Of 80 tons coal at $\$5.62\frac{1}{2}$ per ton.
10. Of $8\frac{3}{4}$ cords of wood at $\$4\frac{1}{4}$ per cord.

11. How are mixed numbers changed in multiplying fractions?
12. How are integers changed to fractional forms?
13. How is the numerator of the product determined?
14. How is the denominator of the product determined?
15. How may the work be shortened by cancellation?
16. Write the rule for the multiplication of fractions.

17. $\frac{25}{39} \div \frac{10}{13} =$ ____
18. $5\frac{1}{10} \div 1\frac{2}{5} =$ ____
19. $6\frac{2}{3} \div 3\frac{2}{13} =$ ____
20. $7\frac{1}{3} \div 4\frac{1}{6} =$ ____
21. $\frac{9}{28} \div \frac{1}{23} =$ ____
22. $\frac{2}{3}$ of $7\frac{9}{20} \div \frac{6}{7} =$ ____
23. $\frac{14}{23} \div \frac{2}{9}$ of $\frac{1}{23} =$ ____
24. $\frac{2}{3}$ of $\frac{27}{40} \div \frac{20}{37} =$ ____
25. $\frac{2}{7}$ of $\frac{8}{9} \div \frac{6}{7}$ of $\frac{3}{4}$ = ____
26. $2\frac{2}{3}$ of $1\frac{1}{4} \div 5\frac{1}{3}$ of $3\frac{3}{4} =$ ____
27. $\frac{2}{3}$ of $2\frac{1}{2} \div \frac{2}{7} \times 1\frac{1}{3}$ = ____
28. $\frac{2}{3}$ of $2\frac{1}{2} \div \frac{2}{9} \times 11\frac{2}{3}$ = ____
29. $\frac{1}{8} \div \frac{1}{8}$ of $\frac{2}{9}$ of $9\frac{3}{8}$ = ____
30. $\frac{9}{20}$ of $4 \div \frac{1}{8}$ of $3\frac{3}{4}$ = ____
31. $\frac{1}{2}$ of $\frac{1}{4}$ of $\frac{3}{4} \div \frac{1}{8}$ of $\frac{2}{5} =$ ____
32. $\frac{2}{7}$ of $2\frac{1}{2} \div \frac{1}{3}$ of $4\frac{1}{2}$ = ____

33. What change in the numerator divides the fraction?
34. What change in the denominator divides the fraction?
35. Explain the inverting of the divisor.

1.

CHICAGO, Jan. 14, 1902.

KENDRICK & Co.

Bought of FARWELL & SONS.

1 case Cassimeres,	176 yd.,	@	$1.87½	
2 cases Prints,	850 "	@	.06¼	
1 bale Drilling,	578 "	@	.14	
5 pieces Flannel,	216 "	@	.62½	
				$

Rec'd pay't by note at 4 mo. FARWELL & SONS.

2.

SEATTLE, June 20, 1902.

MR. JOHN HALL.

Bought of McDOUGALL & SOUTHWICK.

7 yd. Broadcloth,	@	$3.60	
9 " Satinet,	@	1.12½	
12 " Vesting,	@	.90	
24 " Cassimere,	@	1.37½	
			$

3.

RED BLUFF, June 5, 1902.

MR. CHARLES BATES.

Bought of MILLS & COWLES.

67 pairs Calf Boots,	@	$3.75	
108 " Thick "	@	2.62½	
75 " Gaiters,	@	1.12½	
27 " Buskins,	@	.87½	
			$

1. Memorize the

TABLE FOR LINEAR MEASURE.

12 inches (*in.*)	=1 foot (*ft.*)	16½ feet	=1 rod.
3 feet	=1 yard (*yd.*)	40 rods	=1 furlong.
5½ yards	=1 rod (*rd.*)	320 rods	=1 mile (*m.*)

1 mile = 63,360 inches = 5,280 feet = 1,760 yards = 320 rods.

NOTE.—In measuring goods sold by the *yard*, the linear yard is divided into *halves*, *fourths*, *eighths*, and *sixteenths*. In estimating duties in the custom-house, the yard is divided into *tenths* and *hundredths*.

3 barleycorns, or sizes = 1 inch (used by shoemakers).
4 inches = 1 hand (used in measuring height of horses).

2. How many rods in 25% of a mile?
3. How many yards in 25% of a mile?
4. How many feet in 25% of a mile?
5. How many rods in 12½% of a mile?
6. How many yards in 12½% of a mile?
7. How many feet in 12½% of a mile?
8. If a foot is the unit, what are 3 inches?
9. If 3 inches is the unit, what is 1 foot?
10. If 1 mile is the unit, what is 1 furlong?
11. If 8 furlongs is the unit, what is 1 mile?
12. What per cent of a foot are 3 inches? Are 4 inches?
13. What per cent of a yard is 1 foot? Are 2 feet?
14. What per cent of a yard are 6 inches? Are 9 inches?
15. What per cent of a yard are 5½ feet? Are 11 feet?
16. How many rods in .1 of a mile? In .2 of a mile?
17. How many yards in .1 of a mile? In .2 of a mile?
18. How many inches in .1 of a mile? In .2 of a mile?
19. How many yards in 45 feet? In 72 in.? In 4 rods?
20. How many miles in 20% of 1,760 rods? In 12½%?

1. Memorize the

TABLE FOR SURVEYORS' MEASURE.

7.92 inches = 1 link (*l.*)	4 rods = 1 chain (*ch.*)
25 links = 1 rod (*rd.*)	80 chains = 1 mile (*mi.*)

1 mile = 8,000 links = 80 chains.

NOTE. — A *Gunter's chain*, the unit of measure, consists of 100 links, and is 4 rods, or 66 feet, in length.

2. If 1 mile is the unit, what are 40 chains?
3. If 1 chain is the unit, what is 1 rod?
4. If 1 rod is the unit, what are 5 links?
5. What is 20% of a rod? 40% of a rod?
6. What is 25% of a chain?

7. Memorize the

TABLE FOR MARINERS' MEASURE.

9 inches	= 1 span (*sp.*)
8 spans, or 6 feet	= 1 fathom (*fath.*)
120 fathoms	= 1 cable's-length (*c. l.*)
$7\frac{1}{2}$ cable's-lengths	= 1 common mile (*m.*)
$1.15\frac{1}{5}$ common miles	= 1 geographic mile (knot).
3 geographic miles	= 1 nautical league.

1 mile = 880 fathoms = 5,280 feet = 63,360 inches.

NOTE. — The nautical mile (knot) is the same as the geographic mile, and is equal to 6,086.7 feet, or about $1.15\frac{1}{5}$ common miles. It is used to measure distances at sea.

8. What is $16\frac{2}{3}$% of a cable's-length? $12\frac{1}{2}$%?
9. What is $12\frac{1}{2}$% of a cable's-length? $67\frac{1}{2}$%?
10. What is $37\frac{1}{2}$% of a cable's-length? 25%?
11. What is 10 % of a mile, expressed in fathoms?
12. What is $35\frac{3}{4}$% of a mile, expressed in fathoms?
13. What is $87\frac{1}{2}$% of a mile, expressed in fathoms?

1. Memorize the

TABLE FOR SURFACE MEASURE.

144	square inches (*sq. in.*)	= 1 square foot (*sq. ft.*)
9	square feet	= 1 square yard (*sq. yd.*)
30¼	square yards	= 1 square rod (*sq. rd.*)
272¼	square feet	= 1 square rod.
160	square rods	= 1 acre (*a.*)
640	acres	= 1 square mile (*sq. mi.*)

2. Give the dimensions of 25% of a square foot.
3. How many half-yards on one side of a square rod?
4. How many square half-yards in a square rod?
5. Give the dimensions of 2⅛ square yards.
6. If an acre is a unit, what is .5 of the unit?
7. If an acre is the unit, what is .75 of the unit?
8. If an acre is the unit, what is .12½ of the unit?

9. Memorize the

TABLE FOR LAND MEASURE.

625 square links (*sq. l.*)	=1 square rod (*sq. rd.*)
16 square rods	=1 square chain (*sq. ch.*)
10 square chains	=1 acre.
640 acres	=1 square mile (*sq. mi.*)
36 square miles (6 miles square)	=1 township (*tp.*)

10. What per cent of an acre are 5 square chains? 4 square chains?

11. What per cent of an acre are 40 square rods? Are 20 square rods?

12. How many chains in the perimeter of a square section of land?

13. How many chains in the perimeter of a half-section of land?

1. Memorize the

TABLE FOR SOLID MEASURE.

1,728	cubic inches (*cu. in.*)	= 1 cubic foot (*cu. ft.*)
27	cubic feet	= 1 cubic yard (*cu. yd.*)
16	cubic feet	= 1 cord foot (*cd. ft.*)
8	cord feet	= 1 cord (*cd.*)
128	cubic feet	= 1 cord.
24¾	cubic feet of stone	= 1 perch (*P.*)

A *cord* of wood is a pile 4 ft. wide, 4 ft. high, and 8 ft. long.
A *cord foot* is 1 ft. in length of the pile that makes a cord.

2. Give in three forms the dimensions of ½ cord of wood.
3. A cord foot is what per cent of an entire cord?
4. How many cubic feet in a block 3 ft. by 3 ft. by 2 ft? How divide it to get 33⅓% of it? 50% of it?
5. How many cubic feet in a block 3 ft. by 3 ft. by 5 ft? How divide it to get 33⅓% of it? 20% of it?
6. How many cubic feet in a 6-foot cube? How divide it to get 50% of it? 33⅓% of it? 16⅔% of it? 12½% of it?
7. How many cubic feet in a solid 6 ft. by 5 ft. by 3 ft.? How divide it to get its ½? ⅓? ⅕? ⅙?
8. Show two ways to divide a cubic foot to get ½ of it.
9. Show two ways to divide a cubic foot to get ⅓ of it.
10. Show three ways to divide a cubic foot to get ¼ of it.
11. Show three ways to divide a cubic foot to get ⅙ of it.
12. Show three ways to divide a cubic foot to get ⅛ of it.

What per cent of a cubic foot is —

13. A solid 8 inches by 6 inches by 9 inches?
14. A solid 9 inches by 4 inches by 12 inches?
15. A solid 6 inches by 6 inches by 8 inches?
16. A solid 6 inches by 4 inches by 12 inches?

1. Memorize the

TABLE FOR LIQUID MEASURE.

4	gills (*gi.*)	= 1 pint (*pt.*)
2	pints	= 1 quart (*qt.*)
4	quarts	= 1 gallon (*gal.*) = 231 cu. in.
31½	gallons	= 1 barrel (*bbl.*)
63	gallons	= 1 hogshead (*hhd.*)
2	barrels	= 1 hogshead.

(The barrel and hogshead vary in commercial usage.)

2. Memorize the

TABLE FOR DRY MEASURE.

2	pints (*pt.*)	= 1 quart (*qt.*)
8	quarts	= 1 peck (*pk.*)
4	pecks	= 1 bushel (*bu.*)

3. How many gills in 1 pint? In 50% of a pint?
4. How many pints in 12 gills? In 10 gills?
5. How many gills in 1 quart? In 1½ quarts?
6. How many gills in 1 quart 1 pint?
7. How many pints in 2 gallons 2 quarts 1 pint?
8. Find the cost of a gallon of milk at 5 cents a pint.
9. Find the cost of 18 pints of whisky at $8 a gallon.
10. How many gallons of milk can be bought with $1.20, at the rate of 5 cents a quart?
11. How many gallons of oil can be bought with $5, at the rate of 12½ cents a quart?
12. Find the cost of 3 gallons of milk, at the rate of 2 cents a half-pint.
13. Find the cost of 3 gallons 3 quarts of vinegar, at the rate of 10 cents a quart?
14. How many gallons in 33⅓% of a hogshead?

1. Memorize the

TABLE FOR AVOIRDUPOIS WEIGHT.

16 drams (*dr.*)	= 1 ounce (*oz.*)
16 ounces	= 1 pound (*lb.*)
100 pounds	= 1 cental, or hundredweight (*cwt.*)
2,000 pounds	= 1 ton (*T.*)
2,240 pounds	= 1 long ton.

2. How many ounces in 2 lb.? In 4 lb.? In $3\frac{1}{2}$ lb.?

3. How many lb. in $2\frac{1}{2}$ centals? In $3\frac{1}{4}$ centals?

4. How many lb. in 2 tons? In $\frac{1}{2}$ ton? In $3\frac{1}{4}$ tons?

5. How many lb. in 10% of a ton? In $12\frac{1}{2}$%? In 20%?

6. How many lb. in $37\frac{1}{2}$% of a cental? In $66\frac{2}{3}$%? In $87\frac{1}{2}$%?

7. How many ounces in $12\frac{1}{2}$% of a pound? In $12\frac{1}{2}$%? In 25%?

8. What part of a ton are 500 pounds? 400 pounds? 200 pounds?

9. What part of a cental are 20 pounds? 40 pounds? 60 pounds?

10. Find the value of $1\frac{1}{2}$ tons of sugar at 6 cents a pound.

11. Find the value of 12 lb. of cheese at $12\frac{1}{2}$ cents a pound.

12. Find the value of $2\frac{3}{5}$ centals of wheat at \$.80 a cental.

13. Find the value of 3 T. 100 lb. of hay at \$20 a ton.

14. Find the value of 2 lb. 4 oz. of butter at \$.20 a pound.

15. How much hay at \$25 a ton can be bought for \$55?

16. How many times 200 lb. in 2 T. 8 cwt.?

17. How much is gained by buying a pound for \$1 and selling for $12\frac{1}{2}$ cents an ounce?

18. How much will 360 lb. of sugar cost at the rate of 12 lb. for \$1?

19. How much will 60 pounds of potatoes cost at \$.80 a cental?

1. Memorize the

TABLE FOR TROY WEIGHT.

24 grains (*gr.*) = 1 pennyweight (*pwt.*)
20 pennyweights = 1 ounce (*oz.*)
12 ounces = 1 pound (*lb.*)

The gold dollar weighs 25.8 grains.

The silver dollar weighs 412 grains.

The *carat*, very nearly $3\frac{1}{5}$ grains, is used in weighing diamonds and other precious stones.

The word *carat* is also used to express the number of parts of pure gold in jewelry, etc. If 18 parts out of 24 parts are pure gold, and the remaining parts are alloy, the metal is said to be 18 carats fine; if 14 parts out of 24 are gold, the metal is 14 carats fine; etc.

2. What is the weight of a $10 gold-piece in grains?
3. What is the weight of 10 silver dollars in grains?
4. What is the weight of 10 silver dollars in pwt.?
5. What is the weight of 10 silver dollars in ounces?
6. How many pwt. in 3 oz.? In $4\frac{1}{2}$ oz.? In 6.3 oz.?
7. How many pwt. in 10% of an oz.? In 20% of an oz.?
8. How many pwt. in 10% of a pound? In 25%?
9. How many grains in 25% of a pwt.? In $12\frac{1}{2}$%?
10. How many grains in 2.5 pwt.? In 2.25%?
11. How many grains in 2.5 oz.? In 2.25%? In 2.75%?
12. How many oz. in 2.25 lb.? In 4.5 lb.? In $6\frac{1}{3}$ lb.?
13. What part of an ounce are 12 grains? Are 24 grains?
14. What part of a pound are 10 pwt.? Are 12 pwt.?
15. How many pennyweights in a silver dollar?
16. How many pennyweights in a $20 gold-piece?
17. How many carats fine is metal that is $\frac{2}{3}$ gold?

1. Memorize —

A bushel of corn	= 56 pounds.
A bushel of corn-meal	= 50 pounds.
A bushel of wheat	= 60 pounds.
A bushel of potatoes	= 60 pounds.
A bushel of beans	= 60 pounds.
A bushel of oats	= 32 pounds.
A bushel of barley	= 48 pounds.
A bushel of timothy seed	= 45 pounds.

The weight of a bushel of corn, potatoes, etc., varies somewhat in the several states, but the weights here given are usually adopted in business transactions.

2. What is the difference in weight between a bushel of corn-meal and a bushel of wheat?

3. This difference is what per cent of the weight of a bushel of meal?

4. This difference is what per cent of the weight of a bushel of wheat?

5. What is the difference between the weight of a bushel of wheat and a bushel of timothy seed?

6. This difference is what per cent of the weight of a bushel of wheat?

7. This difference is what per cent of the weight of a bushel of timothy seed?

8. What is the difference between the weight of a bushel of oats and a bushel of barley?

9. This difference is what per cent of the weight of a bushel of oats?

10. This difference is what per cent of the weight of a bushel of barley?

1. Memorize—

A barrel of flour	=	196 pounds.
A barrel of pork or beef	=	200 pounds.
A cask of lime	=	240 pounds.
A cental of grain	=	100 pounds.
A quintal of fish	=	100 pounds.
A keg of nails	=	100 pounds.
A long ton	=	2240 pounds.

The *long ton* is used in custom-house business and in measuring coal at the mines.

2. What part of a ton is the weight of a keg of nails?

3. What part of a ton is the weight of a barrel of beef?

4. What is the difference between the weight of a barrel of beef and a cask of lime?

5. This difference is what part of the weight of a cask of lime?

6. This difference is what part of the weight of a barrel of beef?

7. How many tons will 10 barrels of pork weigh?

8. How many tons will 25 casks of lime weigh?

9. How many bushels of wheat weigh as much as a cask of lime?

10. How many bushels of timothy seed weigh as much as 9 kegs of nails?

11. How many bushels of meal weigh as much as $4\frac{1}{2}$ centals of grain?

12. The weight of a bushel of meal is what part of a cental?

13. How many bushels of potatoes in 12 centals?

14. How many barrels of pork weigh as much as 10 casks of lime?

TIME is a measured portion of duration. The unit is a civil day beginning and ending at midnight.

1. Memorize the

TABLE FOR TIME MEASURE.

60 seconds (*sec.*) = 1 minute (*min.*)
60 minutes = 1 hour (*h.*)
24 hours = 1 day (*d.*)
365 days = 1 common year (*yr.*)
366 days = 1 leap year (*l. yr.*)
7 days = 1 week (*wk.*)
12 calendar months (*mo.*) = 1 year (*yr.*)
100 years = 1 century (*cent.*)

The calendar months, and the number of days in each, are as follows:—

January (*Jan.*),	31 days.	July,	31 days.
February (*Feb.*),	28 or 29 d.	August (*Aug.*),	31 days.
March (*Mar.*),	31 days.	September (*Sept.*),	30 days.
April (*Apr.*),	30 days.	October (*Oct.*),	31 days.
May,	31 days.	November (*Nov.*),	30 days.
June,	30 days.	December (*Dec.*),	31 days.

The number of days in each month may be easily remembered by committing to memory these lines:—

Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Except February alone,
To which we twenty-eight assign,
Till leap year gives it twenty-nine.

1. How many seconds in 2 minutes? In $\frac{1}{2}$ minute?
2. How many seconds in $33\frac{1}{3}\%$ of a minute? In 75%?
3. How many minutes in 20% of an hour? In 25%?
4. How many hours in $12\frac{1}{2}\%$ of a day? In 25%?
5. How many minutes in a day? In $\frac{1}{2}$ of a day?
6. How many hours in a common year?
7. How many hours in the winter months?
8. How many hours in the autumn months?
9. How many hours in the spring months?
10. How many hours in the summer months?
11. How many hours in February, 1896?
12. How many hours in February, 1897?
13. How many minutes in February, 1892?
14. How many minutes in February, 1891?
15. How many hours from 8:20 A. M. to 2:40 P. M.?
16. How many hours from 9:15 A. M. to 5:45 next A. M.?
17. How long from Saturday noon to 9 Monday night?
18. How long from 10:45 A. M. Wednesday to 4:20 P. M. Friday?
19. How many days from June 5th to July 23d?
20. How many days from July 4th to September 13th?
21. How many days from August 17th to October 27th?
22. How far will a man walk in $1\frac{1}{2}$ hours at the rate of 1 mile in 15 minutes?
23. How many hours are required to walk $4\frac{1}{2}$ miles at the rate of $\frac{1}{4}$ of a mile in 5 minutes?

NOTE. — The following rule for leap year will render the calendar correct for a period of several thousand years: Every year exactly divisible by 4 is a leap year, except the centennial years; and every centennial year exactly divisible by 400 is a leap year. Thus, 1876 was a leap year, but 1877 was not. Also, the year 2000 will be a leap year, but the year 1900 was not.

1. Memorize the

TABLE FOR COUNTING ARTICLES.

12 units = 1 dozen (*doz.*)	12 gross = 1 great gross.
12 dozen = 1 gross.	20 units = 1 score.

2. Memorize the

TABLE USED BY THE PAPER TRADE.

24 sheets = 1 quire (*qr.*)	2 reams = 1 bundle (*bun.*)
20 quires = 1 ream (*rm.*)	5 bundles = 1 bale (*B.*)

3. A printed book folded in sheets—

Of 2 leaves is called a folio	= 4 pages (*pp.*)
Of 4 leaves is called a quarto, 4to	= 8 pages.
Of 8 leaves is called an octavo, 8vo	= 16 pages.
Of 12 leaves is called a duodecimo, 12mo	= 24 pages.
Of 16 leaves is called a 16mo	= 32 pages.
Of 18 leaves is called an 18mo	= 36 pages.
Of 24 leaves is called a 24mo	= 48 pages.

4. Find the cost of a quire of paper at the rate of $6 a ream.

5. A stationer bought 10 reams of paper at $3 a ream and sold it at 1 cent a sheet. Find the profit.

6. Fifteen dozen pencils were sold out of a great gross. Find the number of pencils remaining.

7. How many sheets of paper required to make an octavo book of 384 pages?

8. A score of boys each had 1 dozen marbles. How many more than a gross did they all have together?

9. What year will be the next leap year?

10. What year was the last leap year?

11. How many sheets required to make this book?

A MEASURE is a standard unit, established by law or custom, by which quantity is measured or estimated.

Measures may be classified into six kinds:—

1. Measures of extension.
2. Measures of capacity.
3. Measures of weight.
4. Measures of time.
5. Measures of angles.
6. Measures of values.

MEASURES OF EXTENSION.

Extension has one or more of the three dimensions,—length, breadth, and thickness. It may be a line, a surface or a solid.

The standard unit in linear, surface, and solid measure is the yard, which is divided into feet and inches. See the tables on pages 152 and 153.

Linear measures are used in measuring lines and distances. Surveyors' linear measures are used by surveyors in measuring roads and boundaries of land. Mariners' measures are used by seamen in measuring distances and in taking the depth of the sea.

TABLE OF EQUIVALENTS IN LINEAR MEASURE.

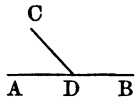
mi.	rd.	yd.	ft.	in.
1 =	320 =	1760 =	5280 =	63360
	1 =	$5\frac{1}{2}$ =	$16\frac{1}{2}$ =	198
		1 =	3 =	36
			1 =	12

mi.	ch.	rd.	l.	in.
1 =	80 =	320 =	8000 =	63360
	1 =	4 =	100 =	792
		1 =	25 =	198
			1 =	79.

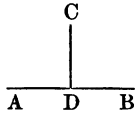
A SURFACE is that which has length and breadth only.

A *plane* surface is one that does not change its direction.

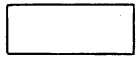
AN ANGLE is the difference in direction of two straight lines which meet at a point, called the *vertex* of the angle; as, A D C or C D B.



Two lines are *perpendicular* to each other when they meet so as to form equal angles. The angles thus formed are called *right angles.*

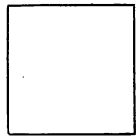


A RECTANGLE is a plane surface with four straight sides and four right angles. The bottom of the figure, or the side on which it is supposed to rest, is its *base;* the side perpendicular to the base is the *altitude.*



A Rectangle.

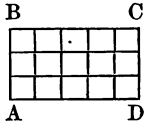
A SQUARE is a rectangle with equal sides.



A Square.

SURFACE or SQUARE MEASURES are those used in measuring surfaces.

Let A B C D be a rectangle whose base A D is 5 inches in length, and whose altitude A B is 3 inches. If A D is divided into 5 equal parts and A B into 3, and lines are drawn through the points of division, the rectangle will be divided into squares, each containing 1 square inch; and the rectangle will evidently contain 5×3 square inches $= 15$ square inches.



Therefore, the area of a rectangle is found by multiplying the square units on one dimension by the other dimension considered abstractly. Conversely, the area of a rectangle divided by the number of square units on one dimension will give the number of square units on the other dimension. Both dimensions must be of the same denomination.

A *cube* is a solid having six equal square faces. If each face be 3 feet on one side, one foot in thickness will contain $3\times3\times1$ cubic foot, or 9 cubic feet; and the whole cube will contain $3\times3\times3\times1$ cubic foot, or 27 cubic feet.

A solid may not have dimensions that are equal. A body that is 4 feet long, 3 feet wide, and 2 feet thick contains $4\times3\times2\times1$ cubic foot, or 24 cubic feet. Hence,

The solid contents of a solid are found by multiplying the length, breadth, and thickness together. And conversely, the volume of a rectangular prism divided by the area of the base will give the altitude; the volume divided by the area of one end will give the length; the volume divided by the area of one side will give the width.

Cubic measure is used in measuring stone, timber, earth, and such other things as have length, breadth, and thickness.

TABLE OF EQUIVALENTS FOR SQUARE MEASURE.

A.	sq. rd.	sq. yd.	sq. ft.	sq. in.
1 =	160 =	4840 =	43560 =	6272640
	1 =	30¼ =	272¼ =	39204
		1 =	9 =	1296
			1 =	144

A.	sq. ch.	sq. rd.	sq. l.
1 =	10 =	160 =	100000
	1 =	16 =	10000
		1 =	625

TABLE OF EQUIVALENTS FOR CUBIC MEASURE.

cd.	cu. yd.	cu. ft.	cu. in.
1	=	128 =	221184
	1 =	27 =	46656
		1 =	1728

MEASURES OF CAPACITY.

Capacity signifies extent of room or space. Measures of capacity are divided into two classes:—

Measures of liquids, and
Measures of dry substances.

Liquid measure is used in measuring liquids, such as milk, water, and liquors. The unit is the gallon, which contains 231 cubic inches.

Dry measure is used in measuring fruits, grain, salt, etc. The unit is the bushel, which contains $2150\frac{2}{5}$ cubic inches. Four quarts, dry measure, contain $268\frac{4}{5}$ cubic inches.

TABLE OF EQUIVALENTS FOR LIQUID MEASURE.

bbl.	gal.	qt.	pt.	gi.
1 =	$31\frac{1}{2}$ =	126 =	252 =	1008
	1 =	4 =	8 =	32
		1 =	2 =	8
			1 =	4

TABLE OF EQUIVALENTS FOR DRY MEASURE.

bu.	pk.	qt.	pt.
1 =	4 =	32 =	64
	1 =	8 =	16
		1 =	2

4 quarts, liquid measure = 231 cubic inches.
4 quarts, beer* measure = 282 cubic inches.
4 quarts, dry measure = 268.8 cubic inches.

* The beer gallon is but little used.

MEASURES OF WEIGHT.

Weight is the measure of the force of gravity, and varies according to the quantity of matter a body contains. The standard of weight is the *troy pound of the mint*, and contains 5760 grains.

Troy weight is used in weighing gold, silver, jewels, and in philosophical experiments.

Avoirdupois weight is used in weighing all articles except gold, silver, and jewels. The pound avoirdupois contains 7000 grains.

TABLE OF EQUIVALENTS FOR AVOIRDUPOIS WEIGHT.

T.		cwt.		lb.		oz.
1	=	20	=	2000	=	32000
		1	=	100	=	1600
				1	=	16

TABLE OF EQUIVALENTS FOR TROY WEIGHT.

lb.		oz.		pwt.		gr.
1	=	12	=	240	=	5760
		1	=	20	=	480
				1	=	24

Druggists, in mixing medicines, divide the troy ounce as indicated by the following table. The grain, ounce, and pound are the same as in troy weight.

TABLE FOR APOTHECARIES' WEIGHT.

20 grains (*gr.*)	=	1 scruple (℈)
3 scruples	=	1 dram (ʒ)
8 drams	=	1 ounce (ʒ)
12 ounces	=	1 pound (℔.)

MISCELLANEOUS EQUIVALENTS.

1 pound avoirdupois = 7000 grains.
1 pound troy = 5760 grains.
1 ounce avoirdupois = 437.5 grains.
1 ounce troy = 480 grains.
144 pounds avoirdupois = 175 pounds troy.
192 ounces avoirdupois = 175 ounces troy.

NOTE. — Notice that a pound troy is lighter than a pound avoirdupois, while an ounce troy is heavier that an ounce avoirdupois.

1 gallon, or 4 quarts, liquid measure, equals 231 cu. in.
½ peck, or 4 quarts, dry measure, equals 268.8 cu. in.
1 bushel, dry measure, equals 2150.4 cu. in.

A box* 16 in. × 12 in. × 11.2 in. contains 1 bushel.
A box 12 in. × 7 in. × 6.4 in. contains 1 peck.
A box 4 in. × 7 in. × 8.25 in. contains 1 gallon.
A box 4 in. × 4 in. × 2.1 in. contains 1 pint.

1 gallon of water weighs 8.33 pounds.
1 cubic foot of water weighs 1000 ounces.

1 oz. = 480 gr.
.1 oz. = 48 gr.
.01 oz. = 4.8 gr.
.001 oz. = .48 gr.
.0001 oz. = .048 gr.

NOTE. — The yard measure used in the United States custom-houses is divided decimally into tenths and hundredths. In the standard weights used by the United States government the troy ounce is divided decimally into tenths, hundredths, thousandths, and ten-thousandths. The value in grains of the parts of an ounce is readily computed.

* Inside measurement.

REDUCTION is the process of changing the form of a quantity without changing its value. Thus, 2 bushels may be expressed as 8 pecks; 14 days may be expressed as 2 weeks; etc.

Reduction descending is the operation of changing a quantity from a higher to a lower denomination.

Reduction ascending is the process of changing a quantity from a lower to a higher denomination.

1. Reduce 2 rd. 4 yd. 2 ft. to inches.

SOLUTION.

2 rd. 4 yd. 2 ft.
$5\frac{1}{2}$
11 yd.
4 yd.
15 yd.
3
45 ft.
2 ft.
47 ft.
12
564 in.

(1) 1 rd.$=5\frac{1}{2}$ yd.
(2) 2 rd.$=2\times5\frac{1}{2}$ yd., or 11 yd.
(3) 11 yd.$+4$ yd.$=15$ yd.

(1) 1 yd.$=3$ ft.
(2) 15 yd.$=15\times3$ ft., or 45 ft.
(3) 45 ft. $+2$ ft.$=47$ ft.

(1) 1 ft. $=12$ in.
(2) 47 ft. $=47\times12$ in., or 564 in.

Therefore, 2 rd. 4 yd. 2 ft. equal 564 in.

2. Reduce 1 da. 1 hr. 15 min. to seconds.
3. Reduce 2 lb. 2 pwt. 2 gr. to grains.
4. Reduce 2 rd. 2 yd. 2 ft. to inches.
5. Reduce 1 long ton 2 cwt. to ounces.
6. Reduce 1 sq. rd. 1 sq. yd. to square inches.
7. Reduce 1 bbl. 1 gal. 1 pt. to gills.
8. Reduce 1 bu. 2 pk. 2 qt. to pints.
9. Reduce 1 mi. 75 l. to inches.
10. Reduce 1 lb. 1 oz. to grains troy.

1. Change 5722 inches to higher denominations.

SOLUTION.

$12)\overline{5722}$ (1) 12 in.=1 ft.

$3)\overline{476}$ ft. +10 in. (2) 1 in.=$\frac{1}{12}$ ft.

$5\frac{1}{2})\overline{158}$ yd.+ 2 ft. (3) 5722 in.=5722×$\frac{1}{12}$ ft., or 476 ft. and *10 in.*

$\overline{2}$

$11)\overline{316}$ half-yd. (1) 3 ft.=1 yd.

28 rd.+4 yd. (2) 1 ft.=$\frac{1}{3}$ yd.

(3) 476 ft.=476×$\frac{1}{3}$ yd., or 158 yd. and *2 ft.*

(1) $5\frac{1}{2}$ yd., or 11 half-yd.=1 rd.

(2) 1 half-yd.=$\frac{1}{11}$ rd.

(3) 158 yd., or 316 half-yd.=316×$\frac{1}{11}$ rd., or 28 rd. and 8 half-yd., or *4 yd.*

Therefore, 5722 in.=28 rd. 4 yd. 2 ft. 10 in.

2. Change 768 pints, liquid measure, to higher denominations.

3. Change 1,610 pwt. to higher denominations.

4. Change 44,400 lb. avdp. to higher denominations

5. Change 266 inches to higher denominations.

6. Change 1,203 sq. rd. to higher denominations.

7. Change 8,100 gills to higher denominations.

8. Change 40,560 minutes to higher denominations.

9. Change 480 gills to higher denominations.

10. Change 396 inches to higher denominations.

11. Change 78,408 sq. in. to higher denominations.

12. Change 384 pints, dry measure, to higher denominations.

13. Change 1,440 grains ap. to higher denominations.

14. How many pounds avdp. in 700 pounds troy?

1. Reduce 11,280 inches to higher denominations.
2. Reduce 517,865 links to higher denominations.
3. Reduce 183,712 inches to higher denominations.
4. Reduce 14,640 feet to higher denominations.
5. Reduce 87,844 inches to higher denominations.
6. Reduce 4,355 inches to higher denominations.
7. Reduce 960 rods to chains.
8. Reduce 2 miles 39 rods to feet.
9. Reduce 6 mi. 87 rd. 7 yd. to feet.
10. Reduce 5 mi. 6 rd. 4 yd. 2 ft. to inches.
11. Reduce 7 mi. 30 ch. 75 l. to links.
12. Reduce 19 rd. 4 yd. 2 ft. to feet.
13. Reduce 8 miles to links.
14. Reduce $5\frac{1}{2}$ miles to fathoms.
15. Reduce $16\frac{3}{4}$ miles to fathoms.
16. Reduce 1 mi. 1 rd. 1 yd. 1 ft. to inches.

17. Reduce to inches and add —

30 rd. 2 ft.
7 fur. 5 in.
5 yd. 1 ft. 7 in.

18. Reduce the answer to the seventeenth problem to higher denominations.
19. Reduce 3 nautical leagues to feet.
20. Make an original problem in reduction, long measure.
21. Make an original problem in reduction, mariners' measure.
22. In reduction descending, what is first multiplied?
23. In reduction descending, what is the first multiplier?
24. What is added to the first product?
25. Write the rule for reduction descending.

1. Reduce 1 square mile to square rods.
2. Reduce 2 sq. yd. 3 sq. ft. to square inches.
3. Reduce 5 acres 100 square rods to square rods.
4. Reduce 3840 square rods to acres.
5. Reduce 3 acres 1 square foot to square inches.
6. Reduce 87,120 square feet to acres.
7. Reduce 1 A. 1 sq. rd. 1 sq. ft. to square inches.
8. Reduce 5 acres 147 square rods to square yards.
9. Reduce 9 sq. yd. 7 sq. ft. to square inches.
10. Reduce 33,796 sq. in. to higher denominations.
11. Reduce 153 A. 87 sq. rd. to square feet.
12. Reduce 67,413 square yards to higher denominations.
13. Reduce 2 cubic yards to cubic inches.
14. Reduce 15 cu. yd. 15 cu. ft. to cubic inches.
15. Reduce 34 cords to cubic inches.
16. Reduce 28 cord feet to cubic inches.
17. Reduce 63,936 cubic inches to cubic yards.
18. Reduce 240 cords to cubic feet.
19. Reduce 4,328 cubic feet to cords.
20. How many square feet in a rectangular lot 50 yards long and 24 yards wide?
21. How many cords of wood in a pile 26 feet long, 4 feet wide, and 8 feet high?
22. How many cords of wood in a pile 6 feet high, 4 feet wide, and 48 feet long?
23. Make an original problem, reduction descending, square measure.
24. Make an original problem, reduction ascending, square measure.
25. Make an original problem, reduction descending, cubic measure.
26. Make an original problem, reduction ascending, cubic measure.

1. Reduce 1 bu. 1 pk. 1 qt. to pints.
2. Reduce 3 hogsheads to gills.
3. Reduce 6,048 gills to higher denominations.
4. Reduce 440 pt., dry measure, to higher denominations.
5. Reduce 6,674 pints, liquid measure, to higher denominations.
6. Reduce 3,420 pwt. to higher denominations.
7. Reduce 18,462 lb. avdp. to higher denominations.
8. Reduce 28,848 lb. avdp. to higher denominations.
9. Reduce 2,024 pwt., dry measure, to higher denominations.
10. Reduce 64,543 oz. avdp. to higher denominations.
11. Reduce 1,000 pwt. to higher denominations.
12. Reduce 10,000 gills to higher denominations.
13. Reduce 6,666 grains troy to higher denominations.
14. Reduce 10 hhd. 1 gal. 1 qt. to pints.
15. Reduce 1 hogshead 2 gallons 3 gills to gills.
16. Reduce 49 bushels 3 pecks 7 quarts to pints.
17. Reduce 9 oz. 18 pwt. 16 gr. to grains.
18. Reduce 1 T. 6 cwt. 4 lb. to ounces.
19. Reduce 6 T. 20 lb. 10 oz. to ounces.
20. Reduce 75 barrels of flour to pounds.
21. Reduce 4,810 pounds of wheat to bushels.
22. Reduce 928 bushels of corn to pounds.
23. Reduce 5,318 pounds of oats to bushels.
24. How many seconds in the month of August?
25. How many minutes from midnight, Christmas eve, to New Year's?
26. How long a time required to walk a mile at the rate of 6 feet per second?
27. State the difference in minutes between the summer months and the spring months, 1899.

DENOMINATE FRACTIONS are fractions expressing one or more of the equal parts of denominate units. Like integers, they are reduced to lower denominations by multiplying, and to higher denominations by dividing. The process is the same for both common and decimal fractions.

1. Reduce $\frac{2}{7}$ of a mile to lower denominations.

SOLUTION.

(1) 1 mile equals 320 rods.
(2) $\frac{2}{7}$ mile equal $\frac{2}{7}$ of 320 rods, or $91\frac{3}{7}$ rods.

(1) 1 rod equals $5\frac{1}{2}$ yards.
(2) $\frac{3}{7}$ rod equal $\frac{3}{7}$ of $5\frac{1}{2}$ yards, or $2\frac{5}{14}$ yards.

(1) 1 yard equals 3 feet.
(2) $\frac{5}{14}$ yard equal $\frac{5}{14}$ of 3 feet, or $1\frac{1}{14}$ feet.

(1) 1 foot equals 12 inches.
(2) $\frac{1}{14}$ foot equals $\frac{1}{14}$ of 12 inches, or $\frac{6}{7}$ inch.

Therefore, $\frac{2}{7}$ mile equal 91 rd. 2 yd. 1 ft. $\frac{6}{7}$ in.

2. What part of 6 feet 8 inches are 2 feet 6 inches?

SOLUTION.

(1) 6 feet 8 inches equal 80 inches.
(2) 2 feet 6 inches equal 30 inches.
(3) 30 inches equal $\frac{30}{80}$, or $\frac{3}{8}$ of 80 inches.

3. What part of a week are 2 days 12 hours?
4. What part of a day are 8 hours 30 minutes?
5. What part of a bushel are 2 pecks 2 quarts?
6. What part of a peck are 4 quarts 1 pint?
7. What part of a gallon are 2 quarts 1 pint?
8. What part of a pound troy are 4 oz. 4 pwt.?
9. What part of a rod is 1 yard 1 foot?

Change to lower denominations—

1. $\frac{2}{5}$ of a day.
2. $\frac{4}{5}$ of a lb. troy.
3. $\frac{5}{8}$ of an acre.
4. $\frac{3}{5}$ of a lb. troy.
5. .8 of a cord of wood.
6. .125 of a bushel.
7. $\frac{3}{10}$ of a day.
8. $\frac{4}{5}$ of a mile.
9. .675 of a lb. troy.
10. .375 of a ream of paper.
11. $\frac{2}{3}$ of $\frac{3}{5}$ of a mile.
12. $\frac{3}{5}$ of 2 cwt. 50 lb.
13. .75 of a bbl. of beef.
14. $\frac{1}{7}$ of 1 mi. 160 rd.
15. $\frac{1}{2}$ of $\frac{3}{8}$ of a yard.
16. $\frac{3}{4}$ of $\frac{7}{8}$ of a rod.
17. $\frac{1}{3}$ of a section.
18. $\frac{3}{5}$ of a leap year.
19. $\frac{1}{5}$ of a lb. troy.
20. $\frac{1}{5}$ of a lb. ap.
21. $\frac{2}{3}$ of a mile.
22. .15 of an acre.
23. .05 of 30 lb. 8 oz. troy.
24. $\frac{2}{3}$ of 3 days 12 hours.
25. $\frac{5}{6}$ of 3 cwt. 36 lb.
26. .475 of a bushel.
27. $\frac{3}{11}$ of an acre.
28. .05 of $\frac{1}{4}$ of a mile.
29. .375 of a long ton.
30. $\frac{7}{24}$ of a mile.

31. What part of a bushel are 2 pk. 4 qt.?
32. What part of a yard are 2 ft. 8 in.?
33. What part of a lb. are 10 oz. 13 pwt. 8 gr.?
34. What part of a lb. avdp. are 14.4 oz.?
35. What part of a day are 10 hr. 40 min.?
36. What part of a ton are 5 cwt. 64 lb.?
37. What part of a lb. troy are 7 oz. 4 pwt.?
38. What part of a rod are 4 yd. 2 ft. 8 in.?
39. What part of a rod is $\frac{1}{8}$ of a foot?

What part—

40. Of 1 bushel are $1\frac{3}{4}$ pecks?
41. Of 2 acres are 96 square rods?
42. Of 37 mi. 40 rd. are 9 mi. 90 rd.?
43. Of 7 bu. 1 pk. 5 qt. are 2 bu. 3 pk. 1 qt.?

Memorize the table on page 147.

PERCENTAGE, as a process, treats of computing in hundredths.

The *rate* is the number of hundredths.

The *base* is the number of which the hundredths are taken.

The *percentage*, as a quantity, is the product of the base multiplied by the rate.

1. Find 5% of 400.

SOLUTION.

This may be considered as a problem in multiplication of decimals. 400 multiplied by .05 equals 20, the percentage. The 5% may be changed to the common fraction, $\frac{1}{20}$; and $\frac{1}{20}$ of 400 equals 20, the required percentage. It is seen that in the equation,

$$400 \times .05 = 20,$$

the base, 400, is the multiplicand, the rate, .05, is the multiplier, and the percentage, 20, is the product.

2. What per cent of 400 is 20?

SOLUTION.

This problem differs from the preceding one only in the omitted factor. The equation is stated,

$$400 \times \_\_ = 20.$$

It is evident that the missing number is found by dividing the product, 20, by 400, which gives the decimal .05, or 5%.

3. 20 is 5% of what number?

SOLUTION.

The equation in this problem is stated,

$$\_\_ \times .05 = 20.$$

The missing factor is found by dividing 20 by .05.

1. What is 25 % of 1,728 inches?
2. What is 33⅓ % of a mile, in feet?
3. What is 12½ % of a barrel, in gills?
4. What is 12½ % of a bushel, in pints?
5. What is 16⅔ % of a day, in seconds?
6. What is 6 % of 2,500? Of 250? Of 25?
7. What is 15 % of 25? Of 2.5? Of 5? Of 10?
8. What is 37½ % of 20? Of 2.5? Of 4? Of 8?
9. What is 2½ % of 400? Of 500? Of 1,200?
10. What per cent of 200 is 20? 40? 50? 100?
11. 75 is 6% of what number? 8%? 10%?

Find the selling price—

12. Of goods costing \$.80, and sold to gain 25%.

SOLUTION.

25% $=\frac{1}{4}$.

$\frac{1}{4}$ of \$.80=\$ .20.

\$.80+\$.20=\$1.00, the selling price.

13. Of goods costing \$600, and sold to gain 20%.
14. Of goods costing \$600, and sold to lose 20%.
15. Of goods costing \$3,300, and sold to lose 33⅓%.
16. Of goods costing \$1,200, and sold to lose 60%.
17. Of goods costing \$3,500, and sold to lose 12½%.

18. If I sell wood which cost \$2.75 a cord, to make 40%, what will be my profit on 500 cords?

19. My bank account showed \$800 to my credit. How much is left if I draw out 35% of it?

20. Of a school of 150 pupils, 4% are absent. How many pupils are present?

21. A house and lot costing \$6,000 was sold at a loss of 3½%. What did it bring, and what was the loss?

1.	$2\frac{1}{2}$	is	10 %	of____.	**33.**	What % of 75 is 7.5?
2.	7	is	$12\frac{1}{2}$ %	of____.	**34.**	What % of 15 is $7\frac{1}{2}$?
3.	5	is	20 %	of____.	**35.**	What % of .75 is .25?
4.	2	is	80 %	of____.	**36.**	What % of 75 is 3?
5.	20	is	20 %	of____.	**37.**	What % of 225 is 9?
6.	18	is	1 %	of____.	**38.**	What % of 55 is $5\frac{1}{2}$?
7.	75	is	75 %	of____.	**39.**	What % of 200 is 25?
8.	18	is	$\frac{1}{2}$ %	of____.	**40.**	What % of 45 is 30?
9.	75	is	$\frac{1}{2}$ %	of____.	**41.**	What % of 45 is 3?
10.	20	is	$33\frac{1}{3}$ %	of____.	**42.**	What % of 45 is 15?
11.	20	is	$12\frac{1}{2}$ %	of____.	**43.**	What % of 45 is 1.5?
12.	20	is	25 %	of____.	**44.**	What % of $\frac{3}{4}$ is .075?
13.	20	is	$37\frac{1}{2}$ %	of____.	**45.**	What % of $\frac{3}{4}$ is $\frac{1}{4}$?
14.	45	is	5 %	of____.	**46.**	What % of .15 is .05?
15.	16	is	$33\frac{1}{3}$ %	of____.	**47.**	What % of 4 is 1?
16.	$12\frac{1}{2}$	is	$16\frac{2}{3}$ %	of____.	**48.**	What % of 4 is $\frac{1}{2}$?
17.	100	is	$33\frac{1}{3}$ %	of____.	**49.**	What % of 4 is 5?
18.	100	is	200 %	of____.	**50.**	What % of 4 is 8?
19.	100	is	$133\frac{1}{3}$ %	of____.	**51.**	What % of 32 is 4?
20.	100	is	150 %	of____.	**52.**	What % of 40 is .4?
21.	.25	is	20 %	of____.	**53.**	What % of 400 is .4?
22.	2.5	is	25 %	of____.	**54.**	What % of 25 is $6\frac{1}{4}$?
23.	2.5	is	$12\frac{1}{2}$ %	of____.	**55.**	What % of 250 is $6\frac{1}{4}$?
24.	63	is	9 %	of____.	**56.**	What % of 110 is 8.8?
25.	220	is	200 %	of____.	**57.**	What % of 118 is 5.9?
26.	525	is	25 %	of____.	**58.**	What % of 250 is 15?
27.	525	is	$2\frac{1}{2}$ %	of____.	**59.**	What % of 50 is 6?
28.	15	is	6 %	of____.	**60.**	What % of 75 is $4\frac{1}{2}$?
29.	5.9	is	5 %	of____.	**61.**	What % of 81 is 13.5?
30.	88	is	8 %	of____.	**62.**	What % of 128 is 16?
31.	40	is	$\frac{1}{2}$ %	of____.	**63.**	What % of 500 is 70?
32.	40	is	$\frac{1}{10}$ %	of____.	**64.**	What % of 170 is $42\frac{1}{2}$?

Find the cost—

1. Of a cow sold for \$60, at a gain of 20%.

SOLUTION I.

The cost $=100\%$,
The gain $=20\%$,
The selling price $=120\%$,
$120\%=\$60$,
$1\%=\frac{1}{120}$ of \$ 60, or \$.50,
$100\%=100\times\$.50$, or \$ 50, the cost.

SOLUTION II.

The gain, 20% $=\frac{1}{5}$,
The cost $=\frac{5}{5}$,
The selling price $=\frac{6}{5}$,
$\frac{6}{5}$ of the cost $=\$60$,
$\frac{1}{5}$ of the cost $=\frac{1}{6}$ of \$60, or \$10,
$\frac{5}{5}$, or the cost $=5\times\$10$, or \$50.

Find the cost—

2. Of cow sold for \$60, at a loss of 20%.
3. Of hay sold for \$8 a ton, at a gain of $33\frac{1}{3}\%$.
4. Of hay sold for \$8 a ton, at a loss of $33\frac{1}{3}\%$.
5. Of wood sold for \$4 a cord, at a loss of 20%.
6. Of wood sold for \$4.50 a cord, at a gain of 20%.
7. Of goods sold for \$ 40, at a loss of $16\frac{2}{3}\%$.
8. Of goods sold for \$350, at a loss of $16\frac{2}{3}\%$.
9. Of goods sold for \$270, at a gain of $12\frac{1}{2}\%$.
10. Of goods sold for \$ 55, at a gain of 10 %.
11. Of goods sold for \$ 42, at a gain of $33\frac{1}{3}\%$.
12. Of goods sold for \$142, at a loss of $33\frac{1}{3}\%$.
13. Of goods sold for \$210, at a loss of $33\frac{1}{3}\%$.
14. Of goods sold for \$560, at a loss of $12\frac{1}{2}\%$.

INTEREST is a sum paid to a money-lender for the use of money borrowed. It is reckoned at a given per cent, and for *one year*, unless some other time is mentioned.

The amount borrowed, on which interest is paid, is called the *principal*.

The *rate* of interest is the number of hundredths of the principal paid annually.

The *amount* is the sum of principal and interest.

1. What is the meaning of decimal fraction?
2. What effect is produced upon a number by removing the decimal point to the right? To the left?
3. How is the decimal point located in a product?
4. How is the decimal point located in a quotient?
5. How is a common fraction changed to a decimal?
6. How is a decimal changed to a common fraction?
7. How is $\frac{1}{10}$ of a number indicated decimally?
8. How is $\frac{1}{100}$ of a number indicated decimally?
9. How is 10% of a number indicated?
10. How is 1% of a number indicated?
11. What part of a number is 1% of it?
12. What part of a number is 10% of it?
13. What part of a number is 6% of it?
14. What part of a number is 5% of it?
15. What part of a number is 25% of it?
16. What part of a number is 50% of it?
17. What is 6% of \$100? Of \$200? Of \$5000? Of \$1000?
18. What is meant by 6% interest? 5%? 10%? 12%?
19. What is 10% of \$200 for 1 year? For 6 months?
20. What is 6% of \$200 for 2 years and 6 months?
21. What is 5% of \$400 for 2 years and 6 months?
22. What is 8% of \$600 for 2 years and 6 months?

Find the interest and amount—

1. Of \$100 for 2 yr. at 6%.
2. Of \$100 for 3 yr. at 6%.
3. Of \$100 for 5 yr. at 6%.
4. Of \$200 for 2 yr. at 5%.
5. Of \$200 for 3 yr. at 5%.
6. Of \$200 for 4 yr. at 6%.
7. Of \$300 for 3 yr. at 8%.
8. Of \$250 for 4 yr. at 8%.
9. Of \$250 for 5 yr. at 10%.
10. Of \$ 50 for 5 yr. at 5%.
11. Of \$200 for $\frac{1}{2}$ yr. at 6%.
12. Of \$150 for 4 mo. at 6%.
13. Of \$800 for 6 mo. at 6%.
14. Of \$800 for 6 mo. at 5%.
15. Of \$800 for 8 mo. at 6%.
16. Of \$900 for 9 mo. at 10%.
17. Of \$450 for 9 mo. at 10%.
18. Of \$1000 for 2 mo. at 12%.
19. Of \$1000 for 7 mo. at 12%.
20. Of \$1000 for 7 mo. at 6%.

21. Find the interest of \$450 for 2 yr. 7 mo. 18 days at 8%.

SOLUTION.

Principal	=\$450.00
Rate	= .08
Interest for 1 year	=\$ 36.00
	2
Interest for 2 yr.	=\$ 72.00
Interest for 6 mo. $=\frac{1}{2}$ of \$36.00	= 18.00
Interest for 1 mo. $=\frac{1}{6}$ of \$18.00	= 3.00
Interest for 15 da. $=\frac{1}{2}$ of \$ 3.00	= 1.50
Interest for 3 da. $=\frac{1}{5}$ of \$ 1.50	= .30
Interest for 2 yr. 7 mo. 18 da.	= \$94.80

Find the interest—

22. Of \$500 for 1 yr. 1 mo. 18 da. at 6%.
23. Of \$550 for 2 yr. 4 mo. 15 da. at 8%.
24. Of \$750 for 2 yr. 3 mo. 6 da. at 6%.
25. Of \$228 for 3 yr. 5 mo. 18 da. at 5%.
26. Of \$432 for 2 yr. 7 mo. 27 da. at 10%.

ANALYSIS is the process of solving problems by comparing their elements or parts. The comparison is made by the use of the equation. There is no fixed rule for the solution of problems, since the nature of each problem determines the method for solution.

1. If 2 books cost 40 cents, what will 3 books cost?

SOLUTION.

If 2 books cost 40 cents,
1 book costs $\frac{1}{2}$ of 40 cents, or 20 cents,
and 3 books cost 3 times 20 cents, or 60 cents.

2. If 3 hats cost \$ 9, what will 2 hats cost?
3. If 3 hats cost \$15, what will 5 hats cost?
4. If 4 coats cost \$16, what will 5 coats cost?
5. If 4 coats cost \$28, what will 5 coats cost?
6. If 5 dozen eggs cost \$1, what will 3 dozen cost?
7. If 6 dozen eggs cost \$1$\frac{1}{2}$, what will 3 dozen cost?
8. If 10 dozen eggs cost \$1, what will 3 dozen cost?
9. If 4 yd. of cloth cost \$ 8, what will 2$\frac{1}{2}$ yd. cost?
10. If 4 yd. of cloth cost \$12, what will 3$\frac{1}{3}$ yd. cost?
11. If 16 yd. of cloth cost \$80, what will 4$\frac{1}{5}$ yd. cost?
12. If $\frac{1}{2}$ doz. pencils cost 30 cents, what will 1 doz. cost?
13. If $\frac{1}{8}$ of my age is 12 years, what is my age?
14. If $\frac{1}{2}$ of my age is 10 years, what is 2$\frac{1}{2}$ times my age?
15. If $\frac{1}{3}$ of my age is 10 years, what is 2$\frac{1}{3}$ times my age?
16. If $\frac{1}{4}$ of my age is 10 years, what is 2$\frac{1}{4}$ times my age?
17. If $\frac{1}{5}$ of my age is 6 years, what is 3$\frac{1}{5}$ times my age?
18. How many times 4 are $\frac{4}{5}$ of 25? Of 100? Of 1000?
19. How many times 5 are $\frac{5}{4}$ of 40? Of 400? Of 4000?
20. How many times 6 are $\frac{6}{5}$ of 36? Of 180? Of 1800?
21. How many times 7 are $\frac{7}{7}$ of 49? Of 490? Of 1960?

Find the cost of —

1. A primer, if 2 primers cost $\frac{3}{5}$ of 40 cents.
2. A yard of cloth, if $\frac{2}{5}$ of 30 yards cost $48.
3. A barrel of flour, if $\frac{2}{7}$ of 28 barrels cost $24.
4. A barrel of grain, if 9 barrels cost $\frac{3}{7}$ of $42.
5. A pound of fruit, if $\frac{3}{4}$ of a pound cost 12 cents.
6. A pound of fruit, if $\frac{3}{8}$ of a pound cost 16 cents.
7. A pound of tea, if $\frac{7}{8}$ of a pound cost 42 cents.
8. A pound of tea, if $\frac{3}{5}$ of a pound cost 24 cents.
9. A cow, if $\frac{5}{8}$ the cost was $25.
10. A cow, if $\frac{3}{5}$ the cost was $15.
11. A cow, if $\frac{6}{5}$ the cost was $42.
12. A cow, if $\frac{8}{5}$ the cost was $56.
13. A watch, if $\frac{4}{3}$ the cost was $28.
14. A watch, if $\frac{2}{5}$ the cost was $20.
15. A watch, if $\frac{7}{9}$ the cost was $42.
16. A watch, if $24 is $\frac{1}{5}$ more than the cost.
17. A watch, if $45 is $\frac{2}{3}$ more than the cost.
18. A watch, if $45 is $\frac{1}{4}$ more than the cost.
19. A watch, if $45 is $\frac{1}{4}$ less than the cost.
20. A watch, if $18 is $\frac{2}{5}$ less than the cost.
21. A watch, if $18 is $\frac{1}{8}$ more than the cost.
22. A watch, if $45 is $\frac{2}{7}$ more than the cost.
23. A watch, if $45 is $\frac{2}{7}$ less than the cost.

24. In a box of apples, $\frac{5}{7}$ of the number are yellow and the remaining 12 are red. How many apples are in the box?

25. In a box of apples, $\frac{4}{5}$ of the number are yellow and the remaining 60 are red. How many apples are in the box?

26. In a box of apples, $\frac{3}{5}$ of the number are yellow and the remaining 120 are red. How many apples are in the box?

1. $\frac{1}{3}$ of 9 = $\frac{1}{4}$ of ___.
2. $\frac{2}{3}$ of 9 = $\frac{1}{4}$ of ___.
3. $\frac{2}{5}$ of 10 = $\frac{1}{4}$ of ___.
4. $\frac{4}{5}$ of 10 = $\frac{1}{3}$ of ___.
5. $\frac{4}{5}$ of 10 = $\frac{1}{4}$ of ___.
6. $\frac{2}{7}$ of 14 = $\frac{1}{5}$ of ___.
7. $\frac{2}{7}$ of 21 = $\frac{1}{6}$ of ___.
8. $\frac{3}{8}$ of 24 = $\frac{1}{6}$ of ___.
9. $\frac{5}{8}$ of 32 = $\frac{1}{5}$ of ___.
10. $\frac{3}{8}$ of 40 = $\frac{1}{4}$ of ___.
11. $\frac{5}{6}$ of 18 = $\frac{1}{8}$ of ___.
12. $\frac{5}{6}$ of 42 = $\frac{1}{3}$ of ___.
13. $\frac{2}{9}$ of 36 = $\frac{1}{6}$ of ___.
14. $\frac{5}{9}$ of 45 = $\frac{1}{5}$ of ___.
15. $\frac{7}{9}$ of 21 = $\frac{1}{4}$ of ___.
16. $\frac{1}{3}$ of 24 = $\frac{1}{4}$ of ___.
17. $\frac{1}{3}$ of 24 = $\frac{2}{3}$ of ___.
18. $\frac{2}{3}$ of 24 = $\frac{4}{5}$ of ___.
19. $\frac{3}{4}$ of 16 = $\frac{2}{3}$ of ___.
20. $\frac{2}{5}$ of 35 = $\frac{2}{3}$ of ___.
21. $\frac{3}{5}$ of 35 = $\frac{3}{4}$ of ___.
22. $\frac{4}{5}$ of 45 = $\frac{3}{5}$ of ___.
23. $\frac{3}{5}$ of 60 = $\frac{4}{5}$ of ___.
24. $\frac{5}{6}$ of 54 = $\frac{3}{4}$ of ___.
25. $\frac{3}{7}$ of 49 = $\frac{3}{5}$ of ___.
26. $\frac{5}{7}$ of 56 = $\frac{5}{8}$ of ___.
27. $\frac{4}{7}$ of 63 = $\frac{4}{9}$ of ___.
28. $\frac{5}{8}$ of 64 = $\frac{8}{9}$ of ___.
29. $\frac{3}{8}$ of 72 = $\frac{3}{5}$ of ___.
30. $\frac{5}{9}$ of 81 = $\frac{5}{7}$ of ___.

Find the cost —

31. Of 2 lb. of sugar, if 5 lb. cost 50 cents.
32. Of 5 lb. of sugar, if 2 lb. cost 16 cents.
33. Of 4 hats, if 3 hats cost $12.
34. Of 7 coats, if 4 coats cost $24.
35. Of 3 apples, if 7 apples cost 35 cents.
36. Of 3 yd. of cloth, if 4 yd. cost $36.
37. Of 7 yd. of cloth, if 8 yd. cost $56.
38. Of 4 pints of milk, if 2 gallons cost $.50.
39. Of 30 sheep, if 18 sheep are worth $45.
40. Of 84 rods of fence, if 48 rods are worth $108.
41. Of 50 chairs, if 40 chairs cost $90.
42. Of 100 gal. of oil, if 30 gal. cost $3.75.
43. Of 20 cows, if 12 cows cost $486.
44. Of 80 lb. of tea, if 130 lb. cost $117.
45. Of 10.5 lb. of coffee, if 11.5 lb. cost $3.45.

Find the least common denominator of—

1. $\frac{1}{2}$ and $\frac{2}{3}$.	**5.** $\frac{1}{3}$ and $\frac{3}{4}$.	**9.** $\frac{2}{3}$ and $\frac{3}{5}$.
2. $\frac{2}{3}$ and $\frac{3}{8}$.	**6.** $\frac{3}{4}$ and $\frac{2}{5}$.	**10.** $\frac{1}{5}$ and $\frac{1}{6}$.
3. $\frac{3}{4}$ and $\frac{3}{5}$.	**7.** $\frac{3}{4}$ and $\frac{5}{6}$.	**11.** $\frac{1}{6}$ and $\frac{1}{7}$.
4. $\frac{3}{8}$ and $\frac{5}{8}$.	**8.** $\frac{3}{4}$ and $\frac{5}{7}$.	**12.** $\frac{3}{8}$ and $\frac{5}{9}$.

Find the sum of—

13. $\frac{1}{2}$ and $\frac{3}{5}$.	**17.** $\frac{1}{2}$ and $\frac{3}{8}$.	**21.** $\frac{3}{8}$ and $\frac{3}{4}$.
14. $\frac{1}{3}$ and $\frac{3}{5}$.	**18.** $\frac{1}{4}$ and $\frac{1}{6}$.	**22.** $\frac{3}{8}$ and $\frac{3}{5}$.
15. $\frac{1}{2}$ and $\frac{1}{7}$.	**19.** $\frac{1}{4}$ and $\frac{3}{7}$.	**23.** $\frac{3}{4}$ and $\frac{3}{5}$.
16. $\frac{1}{5}$ and $\frac{1}{6}$.	**20.** $\frac{1}{5}$ and $\frac{5}{7}$.	**24.** $\frac{3}{5}$ and $\frac{3}{6}$.

Find the difference between—

25. $\frac{1}{4}$ and $\frac{1}{8}$.	**29.** $\frac{1}{8}$ and $\frac{1}{5}$.	**33.** $\frac{1}{5}$ and $\frac{1}{4}$.
26. $\frac{1}{2}$ and $\frac{1}{6}$.	**30.** $\frac{1}{2}$ and $\frac{2}{5}$.	**34.** $\frac{3}{5}$ and $\frac{1}{6}$.
27. $\frac{1}{8}$ and $\frac{3}{4}$.	**31.** $\frac{1}{8}$ and $\frac{3}{5}$.	**35.** $\frac{3}{5}$ and $\frac{1}{8}$.
28. $\frac{1}{8}$ and $\frac{5}{6}$.	**32.** $\frac{1}{4}$ and $\frac{5}{9}$.	**36.** $\frac{2}{5}$ and $\frac{5}{7}$.

37. If 2 men can do a piece of work in 6 days, how long will it require 3 men to do it?

SOLUTION.

If 2 men require 6 days,
1 man requires 2 times 6 days, or 12 days,
and 3 men require $\frac{1}{3}$ of 12 days, or 4 days.

38. If 8 men can do a piece of work in 10 days, in what time can 5 men do it?

39. If 7 men can do a piece of work in 4 days, in what time can 8 men do it?

40. If 2 men can do a piece of work in 15 days, in what time can 5 men do it?

41. If 3 men can do a piece of work in 16 hours, in what time can 8 men do it?

Find the cost—

1. Of 3 boxes of fruit, if 2 boxes cost $3\frac{1}{5}$.
2. Of 4 boxes of fruit, if 14 boxes cost $4\frac{2}{3}$.
3. Of 7 boxes of fruit, if 5 boxes cost $1\frac{1}{4}$.
4. Of 4 boxes of fruit, if 7 boxes cost $2\frac{4}{5}$.
5. Of 5 boxes of fruit, if 3 boxes cost $3\frac{3}{4}$.
6. Of 7 boxes of fruit, if 5 boxes cost $3\frac{3}{4}$.
7. Of 23 lb. of meat, if 24 lb. cost $3.
8. Of 24 lb. of meat, if 30 lb. cost $5.
9. Of $\frac{3}{5}$ of a yd. of cloth, if $\frac{2}{5}$ of a yd. cost $.40.
10. Of $\frac{3}{4}$ of a yd. of cloth, if $\frac{1}{3}$ of a yd. cost $2.
11. Of $\frac{3}{4}$ of a lb. of butter, if 5 lb. cost $1.
12. Of 2 yd. of goods, if $1\frac{3}{4}$ yd. cost $7.24.
13. Of .25 of a gal. of wine, if .85 gal. cost $1.70.
14. Of $\frac{7}{9}$ of an acre of land, if $\frac{11}{17}$ of an acre cost $198.
15. Of $3\frac{3}{4}$ pecks of grain, if 1 qt. costs $2\frac{1}{2}$ cents.
16. Of $3\frac{3}{4}$ lb. of fruit, if 1 oz. costs $1\frac{1}{4}$ cents.
17. Of $3\frac{3}{4}$ gal. of wine, if 1 pt. costs $12\frac{1}{2}$ cents.
18. Of $\frac{2}{3}$ of a yd. of cloth, if $1\frac{3}{8}$ yd. cost $16\frac{1}{2}$.
19. Of $\frac{2}{3}$ of a bbl. of flour, if $\frac{2}{5}$ of a bbl. cost $3.
20. Of $\frac{3}{4}$ of a yd. of ribbon, if $\frac{3}{8}$ of a yd. cost 8 cents.
21. Of $\frac{2}{3}$ of a ton of hay, if $2\frac{1}{2}$ tons cost $30.
22. Of goods that gain $\frac{1}{5}$ of their cost when sold for $12.
23. Of goods that gain $\frac{1}{3}$ of their cost when sold for $12.
24. Of goods that gain $\frac{1}{2}$ of their cost when sold for $12.
25. Of goods that gain $\frac{1}{8}$ of their cost when sold for $45.
26. Of goods that gain $\frac{2}{5}$ of their cost when sold for $21.
27. Of goods that lose $\frac{1}{5}$ of their cost when sold for $120.
28. Of goods that lose $\frac{1}{4}$ of their cost when sold for $120.
29. Of goods that lose $\frac{1}{3}$ of their cost when sold for $120.
30. Of goods that lose $\frac{3}{7}$ of their cost when sold for $120.
31. Of goods that lose $\frac{5}{9}$ of their cost when sold for $120.

In many problems usually solved by analysis, the unknown quantity may be represented by some letter. This method of solution is called ALGEBRA.

1. William and Albert together have 18 marbles. Albert has twice as many as William. How many has each?

SOLUTION.

Let x = William's number,
then $2x$ = Albert's number.
Adding, $3x$ = 18, the whole number.
x = $\frac{1}{3}$ of 18, or 6, William's number.
$2x$ = 2 times 6, or 12, Albert's number.

2. In a class of 15 pupils, there are twice as many boys as girls. How many are there of each?

3. A man traveled 36 miles in 2 days. On the first day he went twice as far as he went on the second day. How far did he go each day?

4. A coat and hat together cost $10. The coat cost 4 times as much as the hat. Find the cost of each.

5. In a school were 20 pupils. There were 4 times as many girls as boys. Find the number of each.

6. Two packages together weigh 32 pounds. One weighs 3 times as much as the other. Find the weight of each.

7. The sum of two numbers is 36. One is 5 times the other. Find the numbers.

8. Two boys together have 60 cents. One has 5 times as many as the other. Find the number belonging to each.

9. What number added to twice itself equals 90?

10. What number added to twice itself equals 63?

11. What number added to twice itself equals 57?

12. What number added to three times itself equals 48?

1. What number added to three times itself equals 140?
2. What number added to five times itself equals 240?
3. What number added to four times itself equals 90?
4. What number added to five times itself equals 120?
5. What number added to six times itself equals 245?
6. What number added to seven times itself equals 360?
7. What number added to five times itself equals 234?
8. What number added to five times itself equals 72?
9. What number added to seven times itself equals 112?
10. What number added to eight times itself equals 216?

11. A flag-pole 36 feet high was broken so that the part left standing was $\frac{1}{3}$ as long as the part broken off. How long was each piece?

SOLUTION.

Let x=the part standing,
then $3x$=the part broken off.
Adding, $4x$=36 feet, the entire length.
x= 9 feet, the part standing.
$3x$=27 feet, the part broken off.

12. Divide \$100 between two men so that one will have $\frac{1}{3}$ as much as the other.

13. Divide \$100 between two men so that one will have $\frac{1}{4}$ as much as the other.

14. Divide \$100 between two men so that one will have $\frac{1}{5}$ as much as the other.

15. A boy earns $\frac{1}{4}$ as much as his father, and they together earn \$3.75 a day. Find the daily wage of each.

16. During a period of 150 working-days a laborer was idle $\frac{1}{4}$ as many days as he worked. How many days did he work?

1. Divide 36 apples among three boys, so that the second will have twice the number of the first and the third will have three times the number of the first.

SOLUTION.

Let x=the number of the first boy,
then $2x$=the number of the second boy,
and $3x$=the number of the third boy.
Adding, $6x$=36, the entire number.
x= 6, the number of the first boy.
$2x$=12, the number of the second boy.
$3x$=18, the number of the third boy.

2. Three men together have \$63. The second has twice the amount of the first and the third has twice the amount of the second. Find the amount of each.

SOLUTION.

Let x=the amount of the first,
then $2x$=the amount of the second,
and $4x$=the amount of the third.
Adding, $7x$=63, the whole amount. Etc., as before.

3. Lowell, Edwin, and Henry together have 60 marbles. Edwin has twice as many as Lowell, and Henry has as many as the other two. Find the number of each.

4. Lowell, Edwin, and Henry together have 90 cents. Edwin has four times as many as Lowell, and Henry has five times as many as Lowell. Find the number of each.

5. Divide 90 into three parts, so that the second will be three times the first and the third will be two times the second.

6. Divide 90 into three parts, so that the second will be four times the first and the third will equal the sum of the other two.

Add by lines and by columns to test speed —

	9.	10.	11.	12.	13.	
1.	4165	+ 7424	+ 9588	+ 8784	+ 1234	= ?
2.	4050	+ 2855	+ 9954	+ 7442	+ 2345	= ?
3.	2827	+ 8679	+ 9598	+ 4745	+ 3456	= ?
4.	2054	+ 7121	+ 4656	+ 9225	+ 4567	= ?
5.	7286	+ 6864	+ 9258	+ 8272	+ 5678	= ?
6.	6515	+ 8026	+ 7962	+ 5016	+ 6789	= ?
7.	7006	+ 2779	+ 6792	+ 1625	+ 7890	= ?
8.	3782	+ 5927	+ 6797	+ 7005	+ 8912	= ?
		+	+	+	+	= ?

14.

CHICAGO, Aug. 26, 1903.

MR. CHARLES SMITH.

Bought of THE LAKE GROCERY CO.

14 lb. of Tea	@	$.75	
9 lb. of Coffee	@	.37½	
50 lb. of Sugar	@	.6¼	
4 lb. of Pepper	@	.37½	
5 lb. of Chocolate	@	.33⅓	
12 lb. of Candies	@	.37½	
			$

Extend, foot, and receipt the above bill.

15. I bought 18 lb. of sugar at 6¼ cents per lb., 15 yd. of muslin at 6¼ cents a yd., 1 doz. cans of corn at 12½ cents per can, 5 lb. coffee at 37½ cents per lb., 30 lb. of rice at 6¼ cents per lb. If I gave in payment a $50 bill, how much should I receive in "change"?

Divide, orally, the following numbers by 6, 7, 8, and 9:—

1. 6578	**6.** 78606	**11.** 69227
2. 7458	**7.** 48387	**12.** 78586
3. 3978	**8.** 69543	**13.** 37968
4. 2705	**9.** 32323	**14.** 86478
5. 7291	**10.** 23456	**15.** 98775

Find the quotient by the shortest method —

16. $63700 \div 70$	**21.** $1275000 \div 5000$
17. $97200 \div 900$	**22.** $108000 \div 2700$
18. $35400 \div 400$	**23.** $152000 \div 380$
19. $84000 \div 800$	**24.** $499800 \div 490$
20. $753000 \div 6000$	**25.** $182700 \div 900$

Find the least common multiple of —

26. 8, 14, 18, 24.	**31.** 4, 6, 14, 15, 21.
27. 13, 26, 52, 78.	**32.** 27, 63, 108, 900.
28. 14, 56, 21, 112.	**33.** 14, 16, 18, 21, 24.
29. 21, 22, 84, 154.	**34.** 14, 42, 49, 84, 98.
30. 40, 60, 200, 240.	**35.** 18, 27, 45, 54, 90.

Find the quotient —

36. $2000 \div .08$	**41.** $787.5 \div 1.25$	**46.** $6.75 \div .015$
37. $.0045 \div 9$	**42.** $.0625 \div .0025$	**47.** $.0288 \div 72$
38. $.0375 \div .03$	**43.** $.10\dot{0}1 \div .013$	**48.** $71.6 \div 250$
39. $.8625 \div 37.5$	**44.** $19000 \div .095$	**49.** $23.421 \div 211$
40. $.7854 \div 11.9$	**45.** $.0352 \div 160$	**50.** $702.63 \div 211$

51. $6 \times 2.4 \times 4.8 \div .012 \times 3.6 \times .02 = ?$
52. $.6 \times .24 \times 4.8 \div 1.2 \times .36 \times .002 = ?$
53. $5 \times .5 \times .05 \div .5 \times .25 \times .005 = ?$
54. $9.8 \times 6.25 \times .07 \div .7 \times .125 \times .49 = ?$

1. $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{6}=$____
$\frac{2}{3}+\frac{3}{4}+\frac{5}{6}+\frac{6}{7}=$____
$\frac{1}{5}+\frac{1}{6}+\frac{1}{7}+\frac{3}{8}=$____
$+\ +\ +\ =$____

2. $\frac{1}{4}+\frac{1}{8}+\frac{1}{9}+\frac{1}{7}=$____
$\frac{1}{3}+\frac{7}{8}+\frac{2}{9}+\frac{3}{4}=$____
$\frac{5}{9}+\frac{4}{7}+\frac{2}{3}+\frac{3}{8}=$____
$+\ +\ +\ =$____

3. $\frac{2}{3}+\frac{4}{5}+\frac{5}{6}+\frac{8}{8}=$____
$\frac{4}{5}+\frac{5}{8}+\frac{7}{12}+\frac{3}{10}=$____
$+\ +\ +\ =$____

4. $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=$____
$\frac{1}{5}+\frac{1}{4}+\frac{1}{3}+\frac{1}{2}=$____
$+\ +\ +\ =$____

5. $\frac{2}{5}+\frac{2}{3}+\frac{1}{2}=$____
$\frac{2}{3}+\frac{1}{4}+\frac{7}{12}=$____
$\frac{7}{8}+\frac{2}{5}+\frac{2}{3}=$____
$\frac{3}{4}+\frac{5}{6}+\frac{5}{12}=$____
$+\ +\ =$____

6. $\frac{5}{6}+\frac{7}{8}+\frac{7}{24}=$____
$\frac{1}{2}+\frac{9}{16}+\frac{11}{12}=$____
$\frac{3}{4}+\frac{4}{5}+\frac{5}{8}=$____
$\frac{2}{3}+\frac{3}{4}+\frac{5}{6}=$____
$+\ +\ =$____

7. $\frac{1}{5}+\frac{3}{4}+\frac{2}{3}=$____
$\frac{5}{6}+\frac{5}{7}+\frac{5}{8}=$____
$\frac{3}{7}+\frac{3}{8}+\frac{3}{5}=$____
$\frac{1}{3}+\frac{5}{6}+\frac{3}{4}=$____
$+\ +\ =$____

8. $5\frac{3}{5}+6\frac{7}{10}+7\frac{5}{16}=$____
$3\frac{4}{9}+7\frac{3}{4}+8\frac{1}{6}=$____
$9\frac{1}{3}+8\frac{1}{5}+9\frac{3}{8}=$____
$+\ +\ =$____

9. $4\frac{1}{2}+2\frac{1}{6}+8\frac{7}{15}=$____
$5\frac{5}{12}+7\frac{3}{8}+9\frac{3}{10}=$____
$7\frac{5}{16}+9\frac{7}{12}+6\frac{5}{6}=$____
$+\ +\ =$____

10. Find the difference between $54\frac{2}{7}$ and $22\frac{3}{5}$.

SOLUTION.

$54\frac{2}{7}$
$22\frac{3}{5}$
$31\frac{24}{35}$

The subtrahend fraction being larger, the $\frac{2}{7}$ is increased by a unit taken from the 4, which, expressed in terms of a common denominator, is $\frac{35}{35}+\frac{10}{35}=\frac{45}{35}$. Then $\frac{45}{35}-\frac{21}{35}=\frac{24}{35}$, the entire remainder being $31\frac{24}{35}$.

11. $111\frac{2}{3}-42\frac{1}{4}=?$
12. $402\frac{1}{2}-13\frac{2}{3}=?$
13. $125\frac{3}{5}-66\frac{5}{6}=?$
14. $227\frac{5}{6}-172\frac{7}{8}=?$
15. $212\frac{1}{2}-108\frac{1}{3}=?$
16. $413\frac{1}{4}-194\frac{1}{8}=?$
17. $162\frac{3}{4}-98\frac{3}{5}=?$
18. $528\frac{3}{8}-239\frac{5}{6}=?$
19. $391\frac{1}{3}-95\frac{2}{5}=?$
20. $436\frac{3}{4}-88\frac{1}{5}=?$
21. $324\frac{5}{6}-85\frac{1}{9}=?$
22. $310\frac{1}{5}-91\frac{3}{4}=?$

Find the value of —

1.	$8 \div \frac{2}{3}$	11.	$\frac{2}{3} \div 8$	21.	$\frac{7}{12} \div \frac{4}{5}$
2.	$10 \div \frac{2}{4}$	12.	$\frac{2}{4} \div 10$	22.	$\frac{5}{9} \div \frac{7}{12}$
3.	$12 \div \frac{4}{5}$	13.	$\frac{4}{5} \div 12$	23.	$\frac{3}{10} \div 3\frac{1}{3}$
4.	$15 \div \frac{5}{7}$	14.	$\frac{5}{7} \div 15$	24.	$4\frac{1}{4} \div 3\frac{1}{3}$
5.	$16 \div \frac{2}{9}$	15.	$\frac{2}{9} \div 14$	25.	$5\frac{3}{5} \div 3\frac{1}{3}$
6.	$21 \div \frac{7}{9}$	16.	$\frac{7}{9} \div 21$	26.	$3\frac{1}{3} \div 2\frac{1}{5}$
7.	$36 \div \frac{4}{11}$	17.	$\frac{4}{11} \div 36$	27.	$\frac{4}{5} \div 2\frac{4}{5}$
8.	$42 \div \frac{7}{8}$	18.	$\frac{7}{8} \div 42$	28.	$6\frac{1}{4} \div 2\frac{1}{2}$
9.	$63 \div \frac{9}{16}$	19.	$\frac{9}{16} \div 63$	29.	$8\frac{3}{4} \div 4\frac{1}{8}$
10.	$154 \div 1\frac{1}{12}$	20.	$1\frac{1}{12} \div 154$	30.	$8\frac{2}{3} \div 4\frac{1}{3}$

31. Add the sum of $10\frac{3}{4}$ and $39\frac{1}{2}$ to their difference.

32. Add the sum of $10\frac{3}{4}$ and $39\frac{1}{2}$ to their product.

33. Find the sum of $12\frac{1}{2} \div 3\frac{3}{4}$ and $12\frac{1}{2} \times 3\frac{3}{4}$.

34. What part of \$6 is $\frac{2}{3}$ of \$4?

35. What fraction added to $\frac{3}{5} + 1\frac{1}{6}$ equals 2?

36. If 12 be subtracted from a number, and but $\frac{4}{5}$ of it remain, what is the number?

37. How many tons of hay will be cut from $7\frac{1}{2}$ acres, at the uniform rate of $\frac{5}{6}$ of a ton from $\frac{2}{3}$ of an acre?

38. How many days are required to earn \$200, at the rate of $\$1\frac{2}{3}$ per day?

39. If .75 of an acre is worth \$56.25, what is the value of $5\frac{2}{3}$ acres?

40. How much cloth will $\$2\frac{1}{4}$ buy, at $\$1\frac{1}{3}$ per yard?

41. How much cloth will $\$1\frac{1}{3}$ buy, at $\$2\frac{1}{4}$ per yard?

42. What number divided by $15\frac{1}{2}$ will give $15\frac{1}{2}$?

43. What number multiplied by $15\frac{1}{2}$ will give 62?

44. If 144 be taken from the sum of two numbers, one of which is 200, there will be 144 left. What is the other number?

1. James spent $\frac{1}{4}$ of his money and lost $\frac{1}{3}$ of the remainder, and had \$6 left. How much had he at first?

2. Give two ways of finding how many more times 16 is contained in 384 than 128.

3. The President's salary is \$50,000 a year. If his expenses are \$2,400 a month, what will he save in a term of four years?

4. The dividend is 30,725, the quotient is 136, and the remainder is 125. Find the divisor.

5. From the sum of $175\frac{3}{4}$ and $85\frac{5}{6}$ take the difference between $35\frac{5}{8}$ and $15\frac{2}{6}$.

6. A woodcutter sold $\frac{4}{7}$ of his wood for \$120, at the rate of \$3 a cord. How much wood had he?

7. If $\frac{3}{5}$ of a farm is worth \$14,000, what is the value of $\frac{5}{8}$ of it?

8. A merchant exchanged 35 bbl. of potatoes at \$1.75 a barrel for 35 bbl. of flour at \$5.50 a barrel and the balance in money. How much money did he receive?

9. Add the sum and difference of $3\frac{1}{3} \times 3\frac{3}{8}$ and $6\frac{1}{3} \div 3\frac{3}{4}$.

10. Reduce to decimals and add: $\frac{3}{8}$, $\frac{2}{5}$, $\frac{3}{25}$, and $\frac{9}{16}$.

11. What part of $\frac{3}{8}$ of 60 miles are $\frac{3}{4}$ of 6 miles?

12. Divide 256 by 16000 and add to it $.0256 \div .0016$.

13. A farmer hauled to market, in the largest possible equal loads, four lots of wheat, containing, respectively, 72 bushels and 168 bushels. How many bushels in each load?

14. A and B each had 240 acres of land. A sold to B 10 acres, then sold to C an amount so as to have left 210 acres less than B had. How many acres did A sell to C?

15. During the month of November the coal bill was \$12. During the month of December the amount used was $\frac{1}{3}$ less, and the rate was $\frac{1}{3}$ more. What was the difference in cost?

1. What is the number, $\frac{1}{2}$ of $\frac{3}{7}$ of which is 39?

2. Find the product of $375 \div .75$ and $.75 \div 375$.

3. Find the quotient of 246×245 divided by $4375 \div 125$.

4. The product is 1123482 and the multiplier is 246. What is the multiplicand?

5. A man bought a farm for \$5,867, built a house upon it at a cost of \$1,850, and then sold the farm for \$7,250. What was his loss?

6. Mr. Smith has a farm of 180 acres. He divides $\frac{1}{6}$ of it into three equal fields. What part of his farm does each field contain, and how many acres?

7. A owned $\frac{7}{8}$ of a farm and sold $\frac{4}{7}$ of his share to B; B sold $\frac{4}{9}$ of what he bought to C; C sold $\frac{5}{7}$ of what he bought to D. What part of the whole farm did D have?

8. A man bought a farm of 472 acres at \$24 an acre. After investing \$3,450 in buildings, he sold the farm for \$33 an acre. Did he gain or did he lose, and how much?

9. A contractor employed 37 laborers for 56 days, 13 for 84 days, 12 for 43 days, and 17 for 21 days. What part was the total amount paid them, at the rate of $87\frac{1}{2}$ cents per day?

10. An estate consisted of \$8,335 and 6 houses valued at \$4,379 each. After paying claims amounting to \$3,976.48 and \$130 lawyer's fee, the rest was divided equally among five heirs. What did each receive?

11. A stock-buyer had in one field 63 cattle, which number was $\frac{7}{8}$ of the number he had in the second field, and $\frac{5}{8}$ of the number in the second field was $\frac{1}{3}$ of the number in the third field. How many cattle in the three fields?

12. Two men start from the same place at the same time and travel in the same direction, one at the rate of 23.75 miles an hour, the other at the rate of 19.5 miles an hour. How many hours will it take for them to be 64.6 miles apart?

1. A man owns $\frac{3}{5}$ of a store, and sells $\frac{2}{3}$ of his share for \$1,640. At that rate. what is the value of the entire store?

2. An estate of \$12,500 was divided among three heirs. The first received \$6,175, the second received \$2,390 less than the first, and the third received the rest. What did the third receive?

3. In a total of 93,565 votes cast for two competitors for office, one received 7,659 more votes than the other. How many votes did each receive?

4. A lady bought 12 yards of silk at $87\frac{1}{2}$ cents a yard, 36 yards of ribbon at $12\frac{1}{2}$ cents a yard, and 24 yards of muslin at $8\frac{1}{3}$ cents a yard. She gave the clerk a \$20 bill. How much change should she receive?

5. Change to decimal form and add $\frac{3}{8}$ and $\frac{1}{16}$.

6. Change to common fractions and add .625, .085, $16\frac{2}{3}$, and $.12\frac{1}{2}$.

7. What number diminished by the difference between $\frac{3}{4}$ and $\frac{2}{5}$ of itself leaves a remainder of 34?

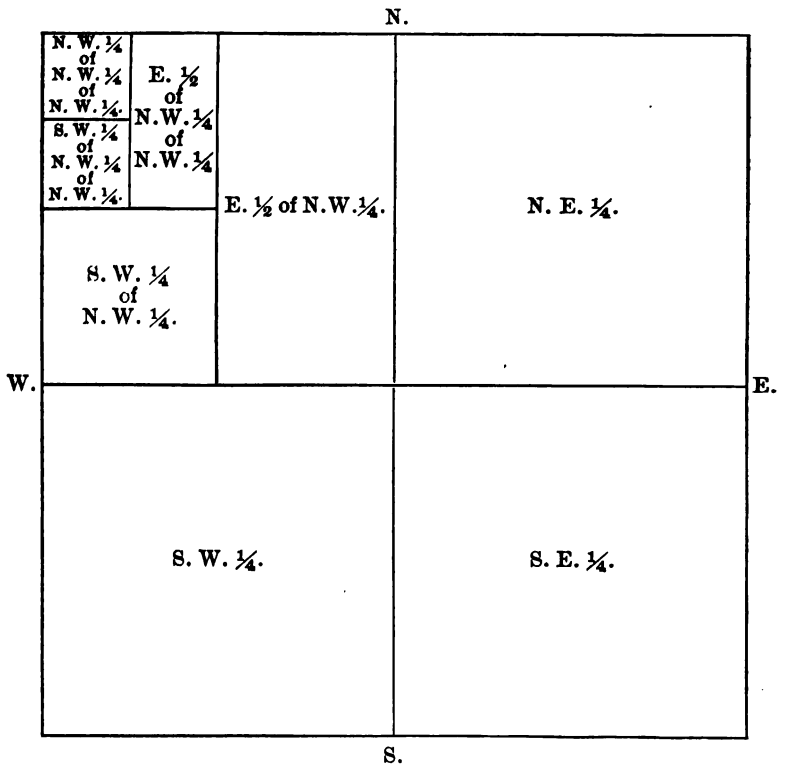
8. A person owning $\frac{3}{7}$ of 2,800 acres of land sold $\frac{2}{3}$ of his share. How many acres did he retain?

9. A man engaged in trade with a stock of goods worth \$3,740. At the end of three years he found that his stock had increased $\$156\frac{1}{3}$ more than $\frac{1}{8}$ the original value of his stock. What was his average annual gain?

10. Two partners engage in business, one putting in $\frac{5}{12}$ of the capital, the other $\frac{7}{12}$. If the first had put in $\$492\frac{2}{3}$ more, their shares would have been equal. How much did each put in?

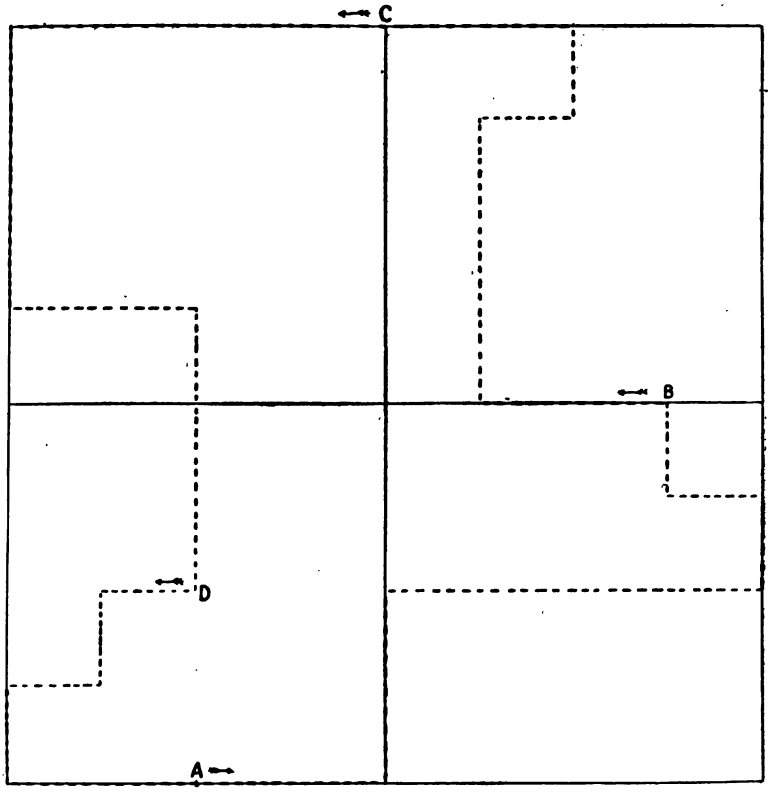
11. A wood dealer had $126\frac{3}{4}$ cords of wood. He sold $\frac{5}{8}$ of it for \$2.75 a cord, and the remainder for \$1.25 a cord. What did he receive for all of his wood?

12. $24\frac{3}{5}+15\frac{1}{2}-3\frac{3}{8}+17\frac{2}{3}-6\frac{5}{9}+6\frac{8}{15}=?$



One Square Mile.

1. How many acres in a quarter-section of land?
2. How many rods around a quarter-section?
3. How many acres in the E. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$?
4. How many rods around the S. W. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$?
5. How many rods around the S. W. $\frac{1}{4}$ and the E. $\frac{1}{2}$ of the N. W. $\frac{1}{4}$, if the two pieces are inclosed in one field?
6. How many acres in the N. W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$?



A Section of Land.

1. Beginning at A, how far on the dotted line around to A again?

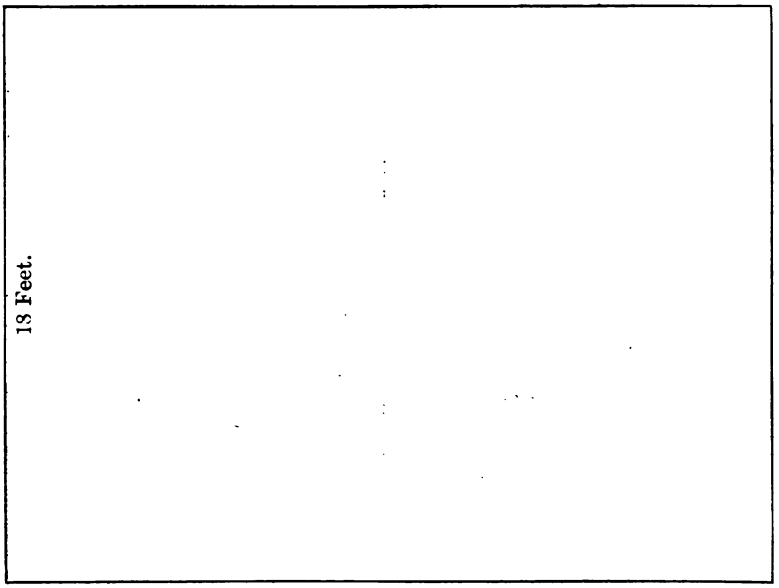
2. What time was taken by a man walking from A to A, at the rate of 3 miles an hour?

3. If he started at 9:15 A. M., when did he get back?

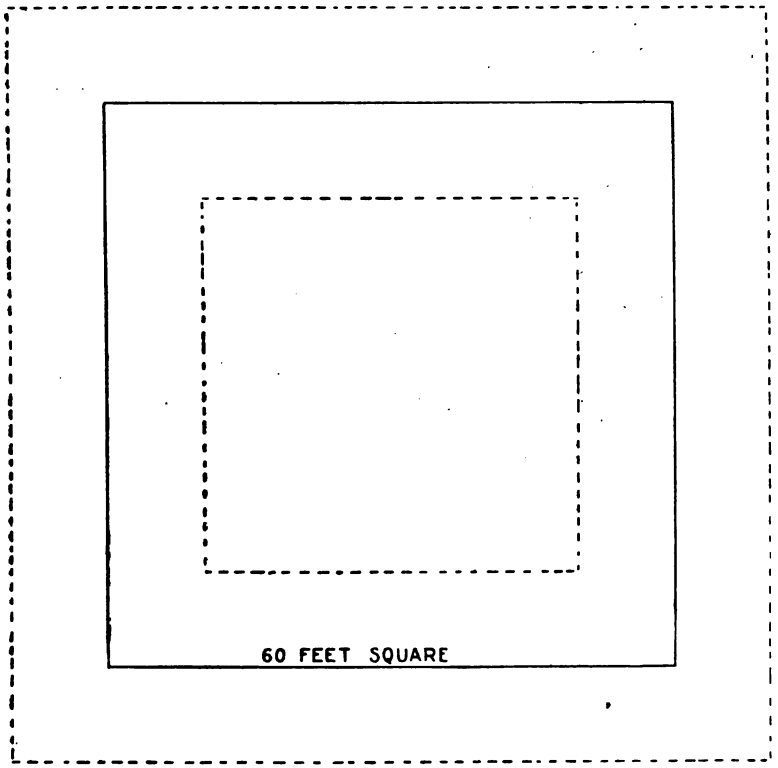
4. At what time was he at B? At C? At D?

5. How far is it from B to D? A to C? C to A?

6. How many acres inclosed by the dotted line?



1. How many yards wide is this room?
2. How many yards long is it?
3. If it is covered with carpet laid the long way, how long will each strip be?
4. How many strips will cover the floor?
5. If the carpet is laid the short way, how many yards in each strip?
6. How many strips will cover the room?
7. If the carpet is $\frac{3}{4}$ of a yard wide, how many long strips will cover the floor?
8. If the carpet is $\frac{3}{4}$ of a yard wide, how many short strips will cover the floor?
9. In laying the carpet the short way, will more carpet be bought than is really required to cover the floor?



A plat of ground is 60 feet square, and has a walk 10 feet wide within the border.

1. What is the area of the entire plat? Of the walk?
2. What fractional part of the lot is the area of the walk?
3. If the walk were outside of the border of the lot, what would be its area?
4. What would be the area of the lot and the outer walk?
5. The part within the inner walk is what part of this area?

The following market reports are taken from a daily paper. Use these facts, or other more recent reports, and make ten original problems, to be presented to the class for solution.

OATS — From 97½@$1.10 per ctl. for black feed and $1.02½@1.15 for red; Seed, $1.15@1.20 for black.

HAY — Wheat, $9.50@12 per ton; Wheat and Oat, $9@11.50; Wild Oat, $6.50@9; Barley, $6@8.50; Volunteer, $6.50@7.50; Clover, $7.50@9.50; Straw, 37@45¢ per bale.

BEANS — Lima, $3.75@3.85 per ctl.; Bayo, $2.95@3.05; Pink, $2.10@2.15; large White, $2.30@2.40; small White, $2.50@2.60; Red Kidney, $2.75@3; Red, $2.50; Pea, $3@3.25; Blackeye, $3.60@3.75.

CORN — $1.42½@1.45 per ctl. for large Yellow and $1.45 for small.

RYE — From 90@92½¢ per ctl.

HOPS — The nominal range is 20@22½¢ per lb.

BUTTER — Creamery, 25@28¢ per lb., some specials 29@30¢; Dairy, 21@25¢; Store, 17@20¢. Cold Storage — Creamery, tubs and cubes, 23@24¢; Pickled Roll, 22@23¢; Dairy, kegs, 20@22¢.

CHEESE — Flats, 10½@11½¢ per lb., some fancy 12¢; Young America, 11½@12½¢; Eastern Cream, 14½@15½¢.

EGGS — California ranch, 26@30¢ per doz. and 31@32½¢ for selected large white; gathered, 21@25¢; Eastern, 21@24¢; California cold storage, 22@25¢.

HONEY — Comb, 11@12¢ per lb. for bright and 9@10¢ for light amber; extracted, 3¼@4¢ for dark amber, 4½@4¾¢ for light amber and 5@5½¢ for water-white.

BEESWAX — From 27@29¢ per lb.

POULTRY — Hens, $4.50@6 per doz.; Broilers, $3@3.25 for small and $3.50@4 for large; Fryers, $3.50@4; Roosters, $4.50@5.50 for old and $4.50@5.50 for young; Geese, $1.25@1.50 per pair; Goslings, $1.50@1.75; Ducks, $2.50@3 per doz. for old and $2.50@4.50 for young; live Turkeys, 15@16¢ per lb.; young do., 17@18¢; Pigeons, $1.25@1.50 per doz. for old and $1.25@1.50 for young.

HAMS AND BACON — Sugar-cured Eastern Hams, 15½¢ per lb.; Bacon, extra light, sugar-cured, 18½@19¢; medium, 13¢; light medium, 13½¢; light, 15¢; extra light, 15½@16¢.

PORK — Clear and extra do., $24 per bbl.; hf. do., $12.25; Extra Mess, $10; hf. bbl., $9.75; Dry Salted Pork, 12½@13¢ per lb.

Explain by original problem or illustration —

1. The method of Roman notation.
2. The decimal scale in reading numbers.
3. The principles of addition.
4. The principles of subtraction.
5. The principles of multiplication.
6. The process of multiplying by 10 or multiple of 10.
7. The division of a concrete number into parts.
8. The division of a concrete number by another concrete number.
9. The relation of addition to subtraction.
10. The relation of addition to multiplication.
11. The relation of division to subtraction.
12. The relation of division to multiplication.
13. The process of dividing by 10 or multiple of 10.
14. The effect on the quotient of multiplying the dividend.
15. The effect on the quotient of multiplying the divisor.
16. The effect on the quotient of multiplying both dividend and divisor.
17. How to find the dividend when the divisor and quotient are given.
18. How composite numbers may be prime to each other.
19. Two principles in finding the G. C. D. by division.
20. Two methods for finding the L. C. M. of numbers.
21. The principle involved in cancellation.
22. The common fraction as an unexecuted division.
23. That $\frac{3}{5}$ of 1 is equal to $\frac{1}{5}$ of 3.
24. The inversion of the divisor in division of fractions.
25. The change in the value of a fraction by changing the numerator.
26. The change in the value of a fraction by changing the denominator.

$7,525.00. SAN FRANCISCO, *June 23*, 1903.

Ninety days after date, without grace, *I* promise to pay to the order of *Sussman, Wormser, and Company* *Seven thousand five hundred twenty-five* Dollars, for value received, with interest at *seven per cent*, both principal and interest payable only in United States gold coin.

Payable at the *San Francisco and London Bank.*

No. *352.* *Carl Schraubstadter.*

Form of Promissory Note.

No. *172.*

SAN FRANCISCO, CAL., *March 3*, 1903.

First National Bank of Fresno.

PAY TO THE ORDER OF *Richardson Sons & Co.* $200.00.

Two hundred $\frac{00}{100}$ Dollars.

Worthington Coolidge.

Form of Check.

1. Write a promissory note due in 3 months, and write a check to pay it when due, including the interest.

2. Write a note to run for 6 months, and a check to pay what is due at the end of that time.

GEOMETRIC FORM STUDY.

Aside from the practical value of form-study in the clear conception of plans and design in manual industry, there is a positive value from constructive drawing in the stimulation of accurate observation and the cultivation of the imagination in the study of form, relation, and beauty.

Pupils should be trained as early as possible in their school life in systematic study. We believe nothing is here given which cannot be well done by pupils of the fifth grade or year, and that added interest in the subject will arise from the simple drawing and construction work presented.

GEOMETRIC FORMS AND MENSURATION.

A *point* has position, but no length, breadth, or thickness.

A *line* has length, but no breadth or thickness.

The ends of a line are points, and are indicated by a letter at each end of the line. The intersection of two lines is a point.

A *straight line* is a line that has the same direction for its entire length.

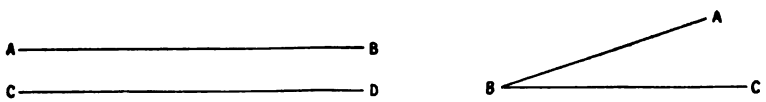
A *curve* is a line that changes its direction at every point throughout its entire length.

A *broken line* is made up of different straight lines.

Straight. Curve. Broken.

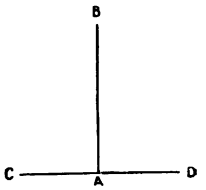
Parallel lines are lines that extend in the same direction and are equally distant at all points.

An *angle* is the difference in direction of two straight lines which meet at a point. The point at which the lines meet is called the *vertex*, and the lines are called the *arms* of the angle. An angle is named by three letters, one placed at the vertex, and one on each of the arms. In naming the angle, the letter at the vertex must be the middle letter. Thus the angle below is read A B C, or C B A.



Parallel Lines. Angle.

If one straight line be drawn to meet another straight line so as to make two equal angles, the lines are said to be *perpendicular*, and the angles are called right angles. Thus A B and C D are perpendicular to each other, and B A C and B A D are right angles.



A line parallel to the horizon is called a *horizontal* line.

A line perpendicular to the horizon is called a *vertical* line.

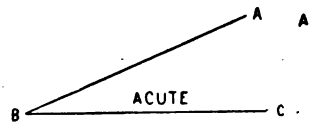
Is a perpendicular line also a vertical line?

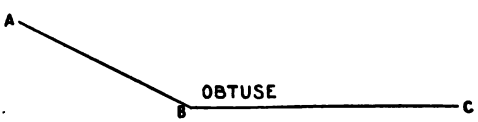
Can curved lines be parallel lines?

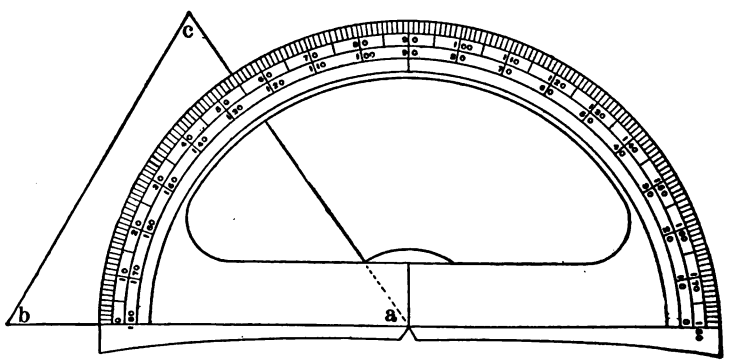
An *acute angle* is one that is less than a right angle.

An *obtuse angle* is one that is greater than a right angle.

Acute and obtuse angles are called *oblique angles*.







Protractor, for Measuring Angles.

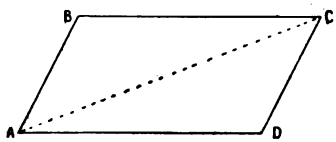
Rhomboid. Rhombus. Rectangle. Square.

A *rectangle* is a parallelogram whose angles are right angles.

A *square* is a rectangle having four equal sides.

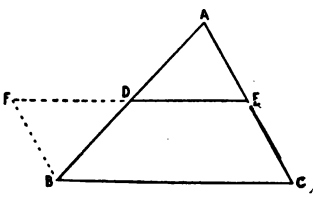
A *rhombus* is a parallelogram having equal sides, and whose angles are oblique angles.

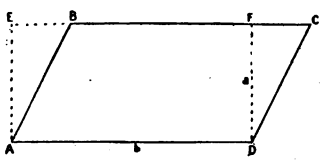
A *rhomboid* is like a rhombus, but having only the opposite sides equal.



1. Draw a diagonal to any parallelogram, and cut the figure into two parts, dividing it at the diagonal. Compare the size of the two parts.

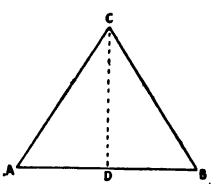
2. Cut a triangle into two pieces, and arrange them so as to form a parallelogram.



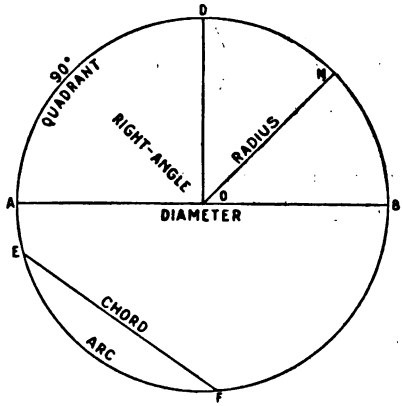


3. Cut a rhomboid into two pieces, and arrange them so as to form a rectangle.

4. Cut an isosceles triangle into two pieces, and arrange them so as to form a rectangle.



5. Cut a trapezoid into two pieces, and arrange them so as to form a parallelogram.



A *circle* is a part of a plane bounded by a curve called the *circumference*, all points of which circumference being equally distant from a point within called the *center*.

An *arc* is any part of a circumference.

A *quadrant* is an arc equal to one fourth of the circumference.

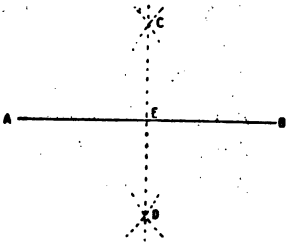
A *radius* is a straight line drawn from the center to the circumference.

A *diameter* is a straight line drawn through the center of a circle and terminated at each end by the circumference.

1. Are all radii of a circle equal? Why? (See definition.)
2. Are all diameters of a circle equal? Why?
3. Are two circles equal when their radii are equal?
4. How does a diameter divide a circle?
5. How is a circle folded to mark a diameter?
6. How is a circle folded to make four equal parts?
7. Is a chord shorter than a diameter?
8. Does an arc equal one half the circumference?

1. *How to bisect a straight line.*

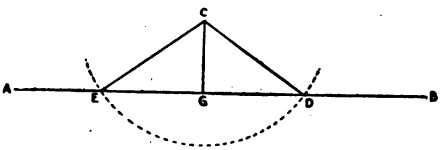
Take any given line; as, A B. With A and B as centers, using equal radii, draw the arcs intersecting at C and D. Draw the line C D, intersecting A B at E. The point E is in the middle point of A B.



An arc is bisected by the same method.

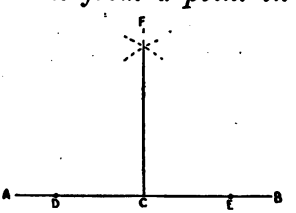
2. *How to draw a perpendicular from a point to a line.*

Let C be a given point, and A B be a given line. From C as a center, draw an arc cutting A B at the two points D and E. Bisect D E and draw a straight line from the middle point G to C. The line C G will be perpendicular to A B.



3. *How to draw a perpendicular to a line from a point in the line.*

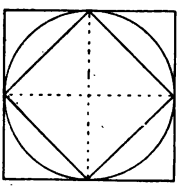
Let C be the given point on the line A B. With C as a center, draw arcs cutting A B at D and E, equally distant from C. With D and E as centers, and with equal radii, draw the arcs intersecting at F. Draw the straight line C F. It will be perpendicular to A B.



4. How can the center of a square be found?

5. How can a circle be drawn in a square so as to touch the four sides?

6. How can a circle be drawn outside of a square so as to touch each corner?



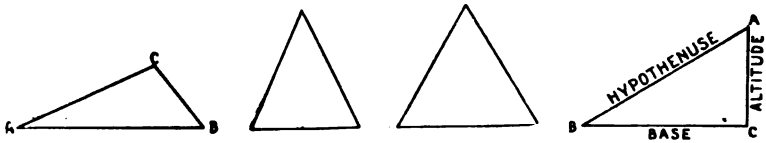
A *triangle* is a plane surface bounded by three straight lines.

A *scalene* triangle is one with no two sides equal.

An *isosceles* triangle is one having two sides equal.

An *equilateral* triangle is one having all sides equal.

A *right triangle* is one that has a right angle.



Scalene. Isosceles. Equilateral.

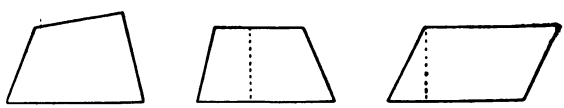
A *quadrilateral* is a plane surface bounded by four straight lines. A straight line that joins any two opposite angles of a quadrilateral is called a *diagonal.*

A *trapezium* is a quadrilateral having no two sides parallel.

A *trapezoid* is a quadrilateral having but two sides parallel.

A *parallelogram* is a quadrilateral whose opposite sides are parallel.

The parallel sides of a quadrilateral are called its *bases,* and the perpendicular distance between the bases is called its *altitude.*



Trapezium. Trapezoid. Parallelogram.

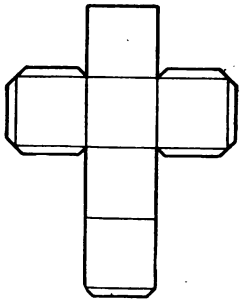
Is an isosceles triangle an equilateral triangle?

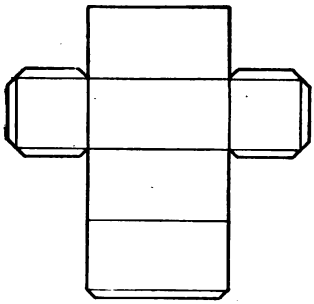
Is an equilateral triangle an isosceles triangle?

May a right triangle be a scalene triangle?

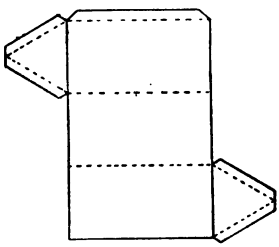
May a right triangle be an isosceles triangle?

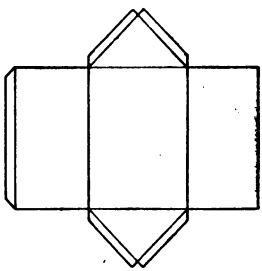
PAPER-CUTTING.



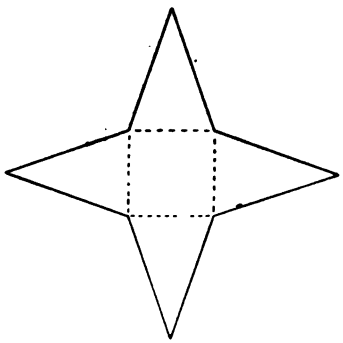


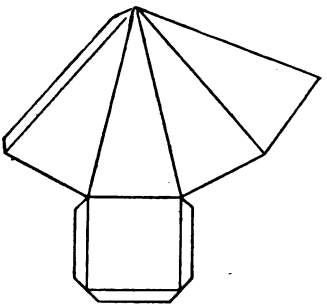
1. Construct from paper a 3-inch cube.
2. Construct from paper a box 2 in. by 2 in. by 3 in.
3. Construct from paper a box 3 in. by 3 in. by 2 in.
4. Compute the area of each of these three boxes.
5. Compute the solid contents of each of these boxes.



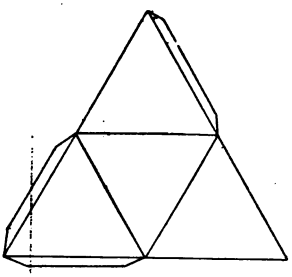


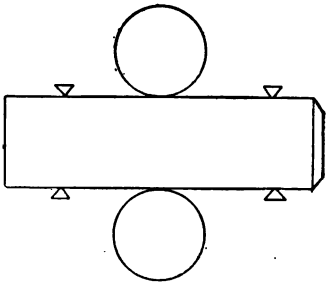
6. Construct a triangular prism each edge of which is 3 inches long.
7. Compute the area of the prism.
8. What kind of triangles are the ends?
9. Make a prism having its ends right triangles.





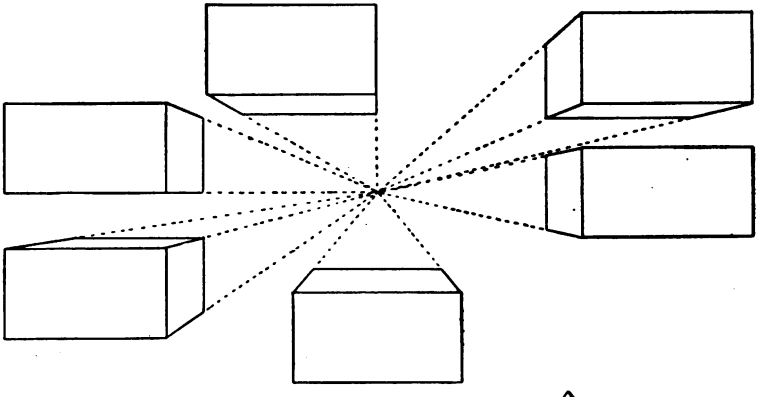
1. Construct from paper a square pyramid.
2. Compute the area of the square pyramid.
3. What kind of triangles are the sides?
4. May the sides of a square pyramid be equilateral?

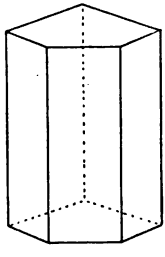




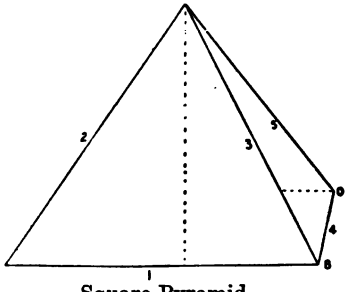
5. Construct a triangular pyramid.
6. Compute the area of the triangular pyramid.
7. What kind of triangles are the sides?
8. Can a triangular pyramid have right triangles for sides?
9. Can a square pyramid have right triangles for sides?
10. Construct from paper a cylinder.
11. Compute the area of its curved surface.

A DRAWING LESSON.

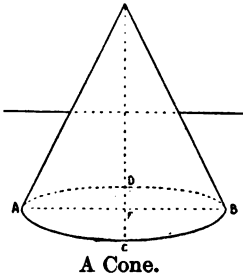




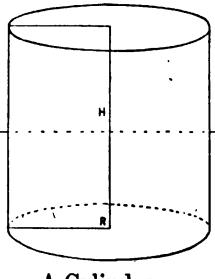
Right Prism.



Square Pyramid.



A Cone.



A Cylinder.

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